



Curtis Rising Star Science Challenge

Engineering Notebook

Level: Advanced

This engineering journal belongs to:

Name: _____

Design a Scaffolding System

Goal: Design a scaffolding system.

Height:

My scaffolding system must be at least _____ .

Strength:

My scaffolding system must support at least _____ for 30 seconds.

My scaffolding system must be **stable**. This means...

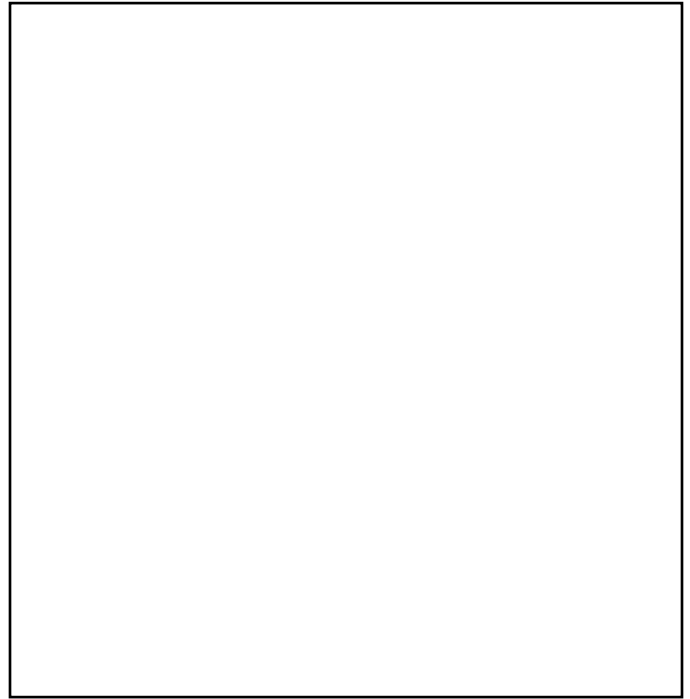
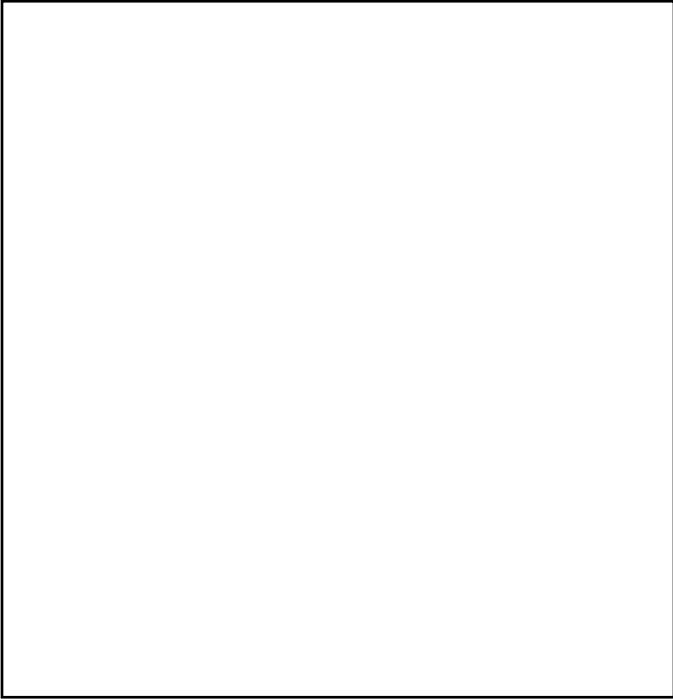
The measurement of the book my scaffolding system must support is:

Length: _____

Width: _____

Imagine

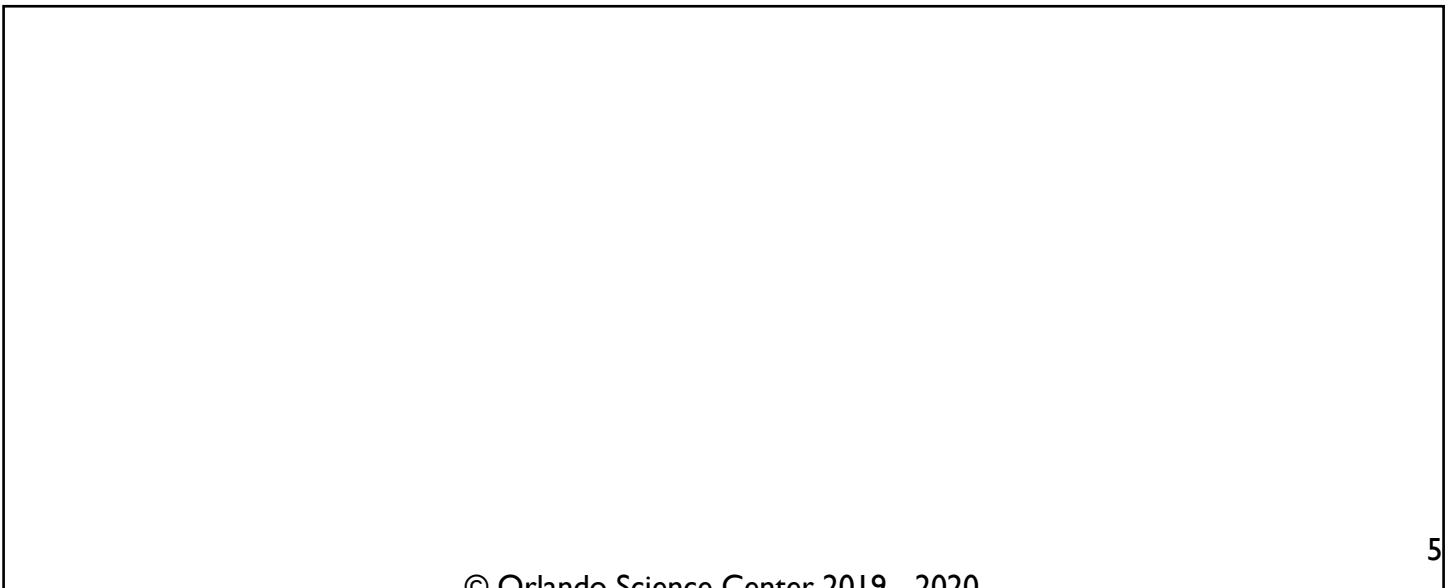
Imagine at least two solutions to the problem.



Plan

Work with your group to come up with a plan.

Draw the plan for your design below.



Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test I

The perimeter of the top of our design is: _____ .

Check off the criteria your group met. Record test data on your graph.

☐ Our design is tall enough.

Our design height is: _____ .

☐ Our design is stable.

- ☐ Our design can support the workers' mass for 30 seconds.

The total mass our design can support is: _____ .

Improve

What will your team improve about your design? Why?

Test 2

The perimeter of the top of our improved design is: _____ .

Check off the criteria your group met for your improved design. Record test data on your graph.

- ☐ Our improved design is tall enough.
Our improved design height is: _____ .
- ☐ Our improved design is stable.
- ☐ Our improved design can support the workers' mass for 30 seconds.

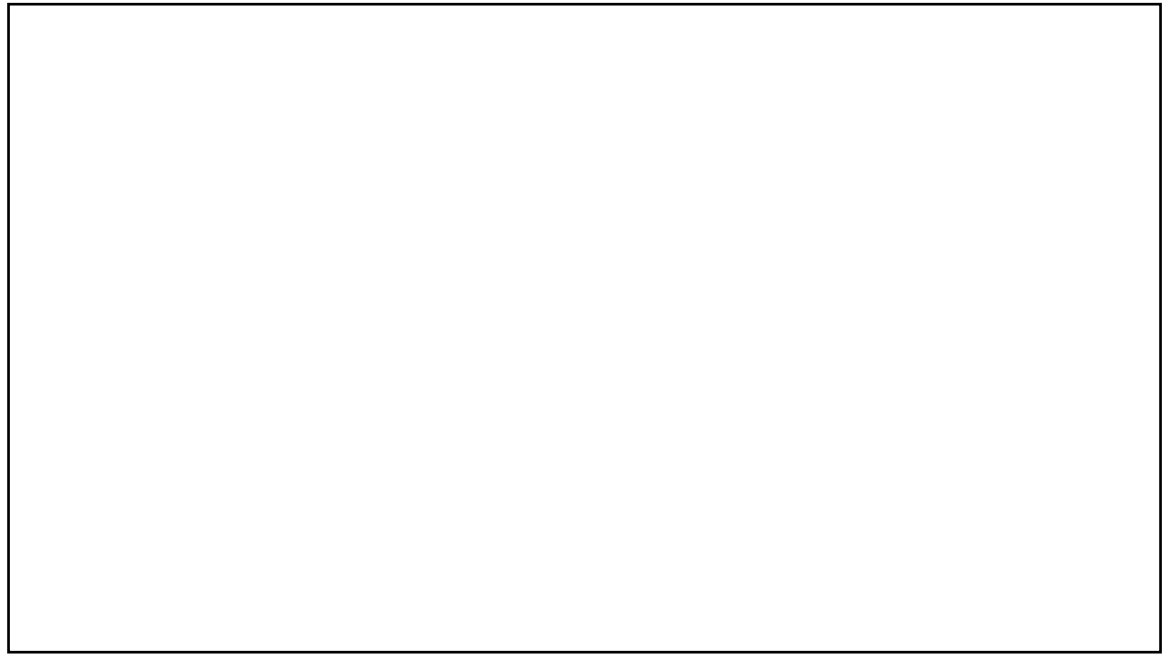
The total mass our improved design can support is: _____ .

Data Graph

Record the data from the first and second test below.

Height

Height

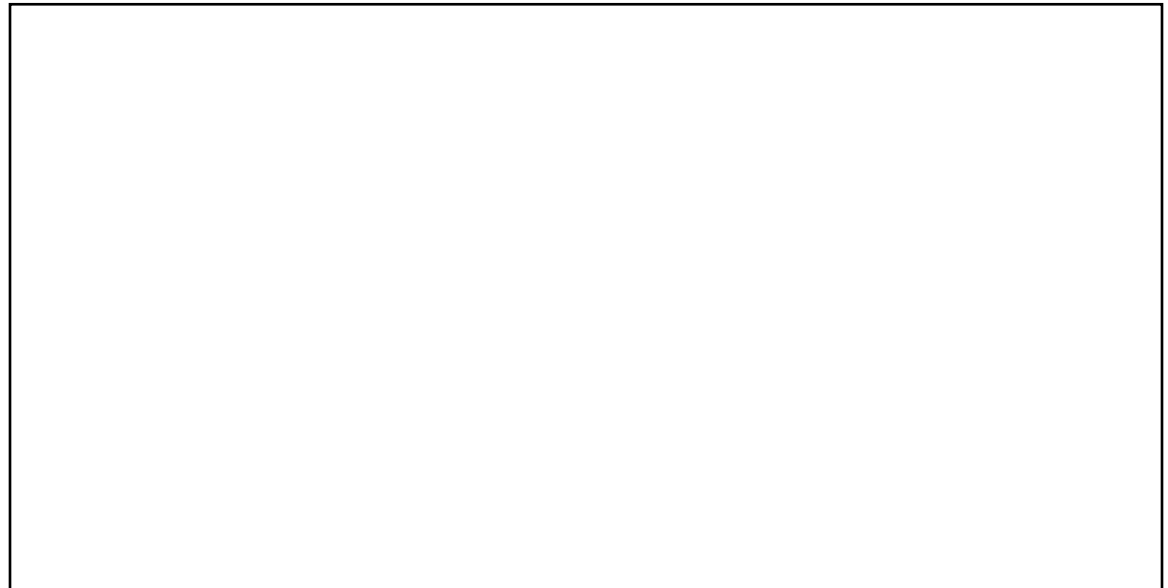


Test I

Test I

Mass
supported

Strength



Reflect: Was your Test I Test I improved design more
successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Design a Roller Coaster

Goal: Design a roller coaster.

My scaffolding system must be **safe**. This means...

My roller coaster must be **fun**. This means...

Imagine

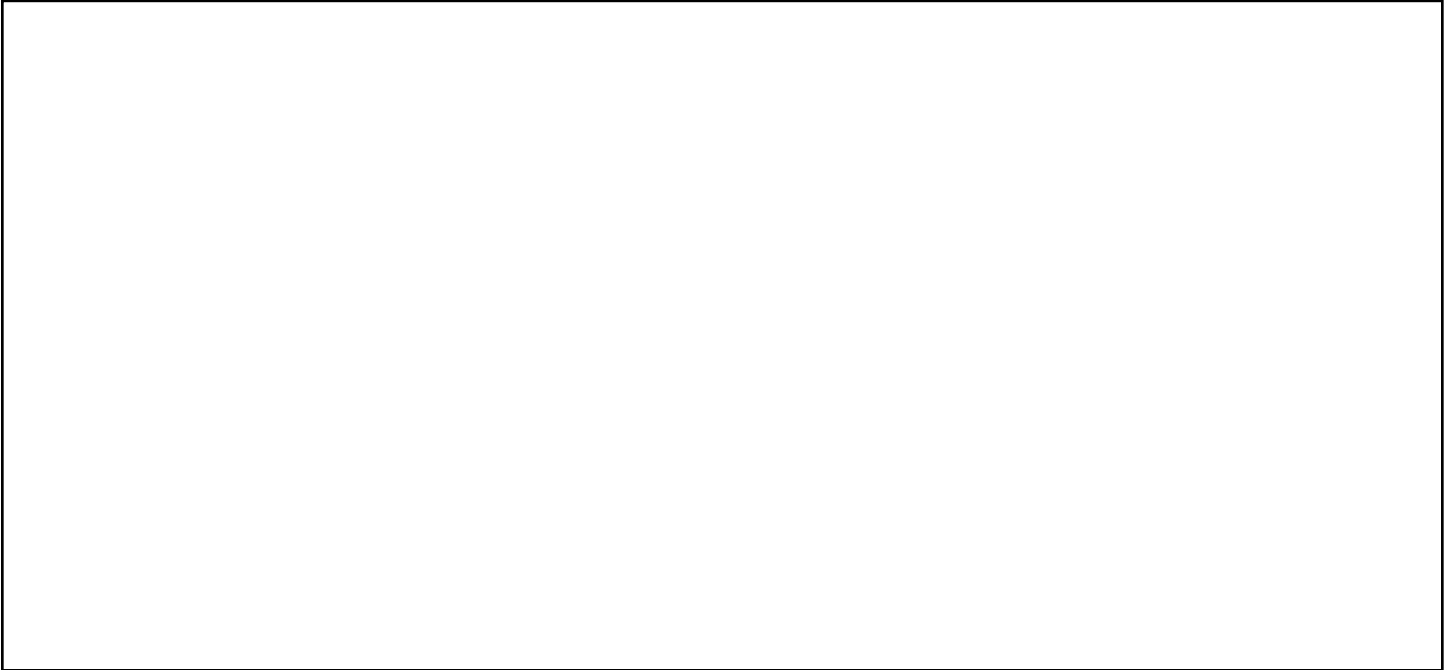
Imagine at least two solutions to the problem.

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Plan

Work with your group to come up with a plan.

Draw the plan for your design below.



Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test I

The length of our roller coaster track is: _____ .

The length of time the car was on the track is _____.

$$\begin{array}{c} \text{_____} \\ \text{Speed} \end{array} = \begin{array}{c} \text{_____} \\ \text{Distance} \end{array} \div \begin{array}{c} \text{_____} \\ \text{Time} \end{array}$$

Check off the criteria your group met. Record test data on your graph.

- ☐ Our design is safe.
- ☐ Our roller coaster is the fastest design.

Improve

What will your team improve about your design? Why?

Test 2

The length of our roller coaster track is: _____ .

The length of time the car was on the track is _____.

$$\frac{\text{Speed}}{\text{Speed}} = \frac{\text{Distance}}{\text{Distance}} \div \frac{\text{Time}}{\text{Time}}$$

Check off the criteria your group met. Record test data on your graph.

- ☐ Our design is safe.
- ☐ Our roller coaster is the fastest design.

Data Graph

Record the data from the first and second test below.

Speed



Test 1

Test 1

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Design Play Dough

Goal: Design a recipe which will produce high-quality play dough.

Play Dough Quality		
High Quality 3	Medium Quality 2	Low Quality 1

Imagine

List the properties of each material:

- Flour: _____
- Salt: _____
- Water: _____
- Cream of Tartar: _____
- Oil: _____

What do you think went wrong with the low-quality play dough? Why?

Plan

Work with your group to come up with a plan.

Write the steps of your recipe.

- When adding materials, record how many full or $\frac{1}{2}$ tablespoons you will add.
- When stirring or kneading, record how many seconds you will do so for.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Test I

Properties of our play dough:

Play dough rating: _____

Improve

What will your team improve about your design? Why?

Test 2

Properties of our play dough:

Play dough rating: _____

What fraction of your play dough was made up of each material?

- Flour: _____
- Salt: _____

- Water: _____
- Cream of Tartar: _____
- Oil: _____

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Water Runoff Reduction System

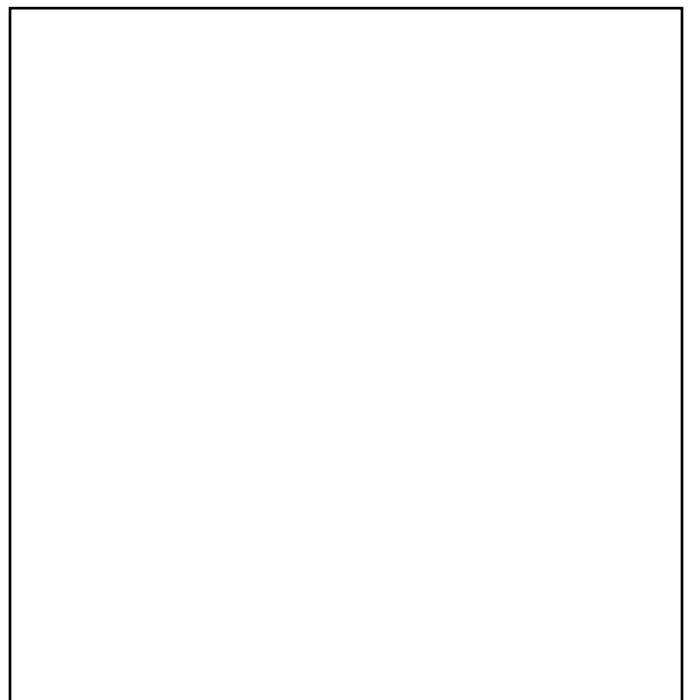
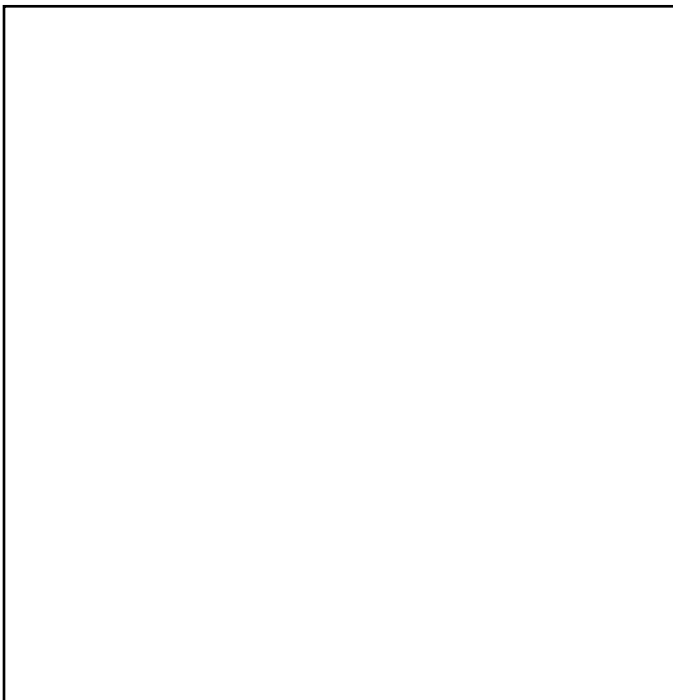
Goal: Design a system which will reduce water runoff from an urban landscape into a nearby lake.

Original lake level: ____ cm

Create a system which will reduce water runoff in an urban landscape to less than ____ cm.

Imagine


Imagine at least two solutions to the problem.



Plan

Work with your group to come up with a plan.

Draw the plan for your design below and calculate your budget.



Budget: \$ _____

Material	Unit cost	Quantity	Extended Cost
Aluminum foil (per sq. in.)	\$		\$
Felt (per sq. in.)	\$		\$
Rock	\$		\$
Duct tape (per in.)	\$		\$
Sponge	\$		\$
Craft stick	\$		\$
Sand (per tbsp.)	\$		\$

Total Cost: \$

Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test I

Water level after rain: _____ cm

Did you meet the criteria? Why or why not?

Improve

What will your team improve about your design? Why?

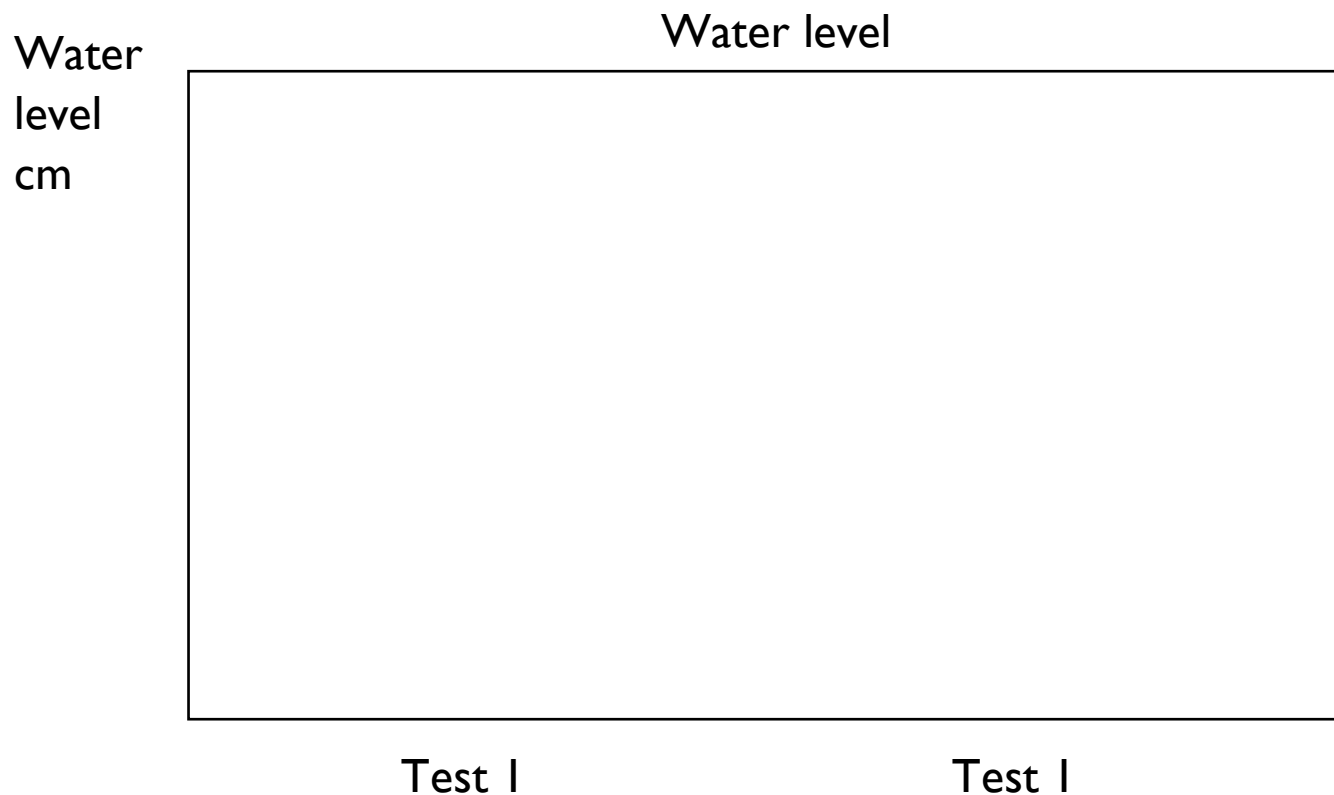
Test 2

Water level after rain: _____ cm

Did you meet the criteria? Why or why not?

Data Graph

Record the data from the first and second test below.



Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Create a Zip Line

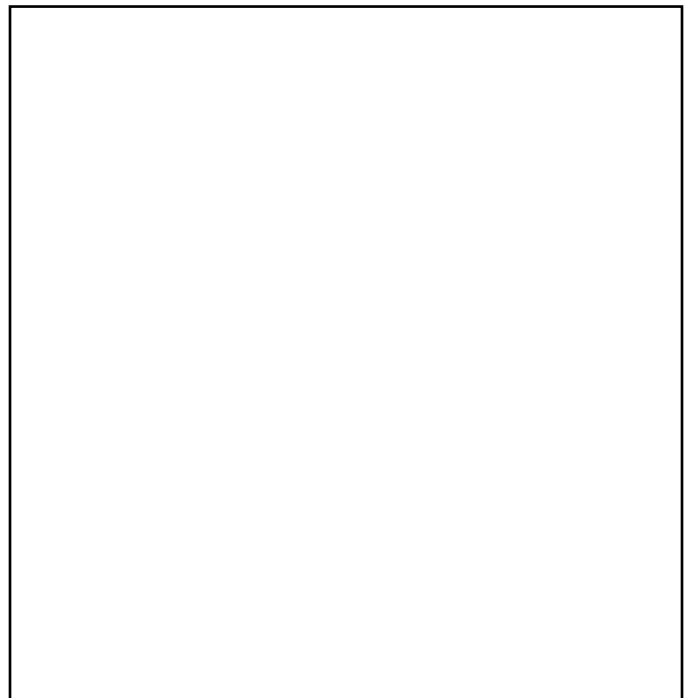
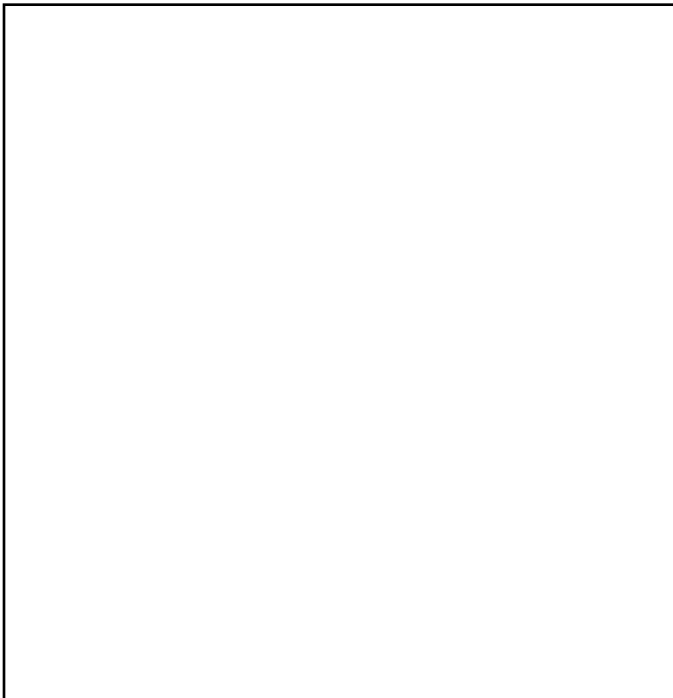
Goal: Design a container which can transport a company's products using a zip line to a town on the other side of a protected forest.

Distance: _____

The container must deliver the payload into the destination without dropping on the ground.

Imagine


Imagine at least two solutions to the problem.



Plan

Work with your group to come up with a plan.

Draw the plan for your design below and calculate your budget.



Check off the 5 materials *your group* will use. You may select an item multiple times.

<input type="checkbox"/> Small paper cup <input type="checkbox"/> Large paper cup <input type="checkbox"/> Index card <input type="checkbox"/> Wax paper, 12 in. x 12 in. <input type="checkbox"/> Paper clip	<input type="checkbox"/> Plastic cup <input type="checkbox"/> Paper <input type="checkbox"/> Yarn, 12 in. <input type="checkbox"/> Aluminum foil 12 in. x 12 in. <input type="checkbox"/> Masking tape, 12 in.
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Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test I

Check off the criteria your group met. Record test data on your graph.

- ☐ Our design is stable. The payload did not drop onto the ground.
- ☐ Our design traveled far enough.

The distance our container traveled is: _____ .

- ☐ Our design delivered the payload successfully to the destination.

The total payloads our design can transport is: _____ .

Improve

What will your team improve about your design? Why?

Test 2

Check off the criteria your group met. Record test data on your graph.

- ☐ Our design is stable. The payload did not drop onto the ground.
- ☐ Our design traveled far enough.

The distance our container traveled is: _____ .

- ☐ Our design delivered the payload successfully to the destination.

The total payloads our design can transport is: _____ .

Distance Number Line

Create a number line below which shows the distance your design traveled in each test.

|

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Design a Paper-Copter

Goal: Design a paper-copter which will drop slowly to the ground.

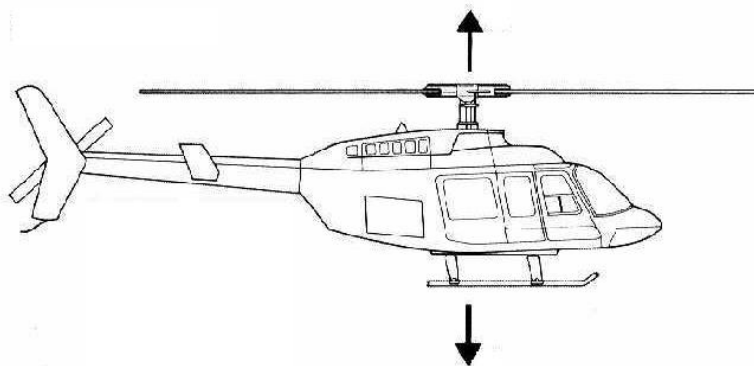
Drop Height:

The paper-copter will be dropped from a height of _____.

Mass:

My paper-copter will carry a load of 5 grams.

My paper-copter blades will create **drag**. This means...



Imagine

Blade Size Test:

Size	Small Perimeter: Area:	Large Perimeter: Area:
Seconds to Fall		

Which size blade was more successful? Why?

Mass Test:

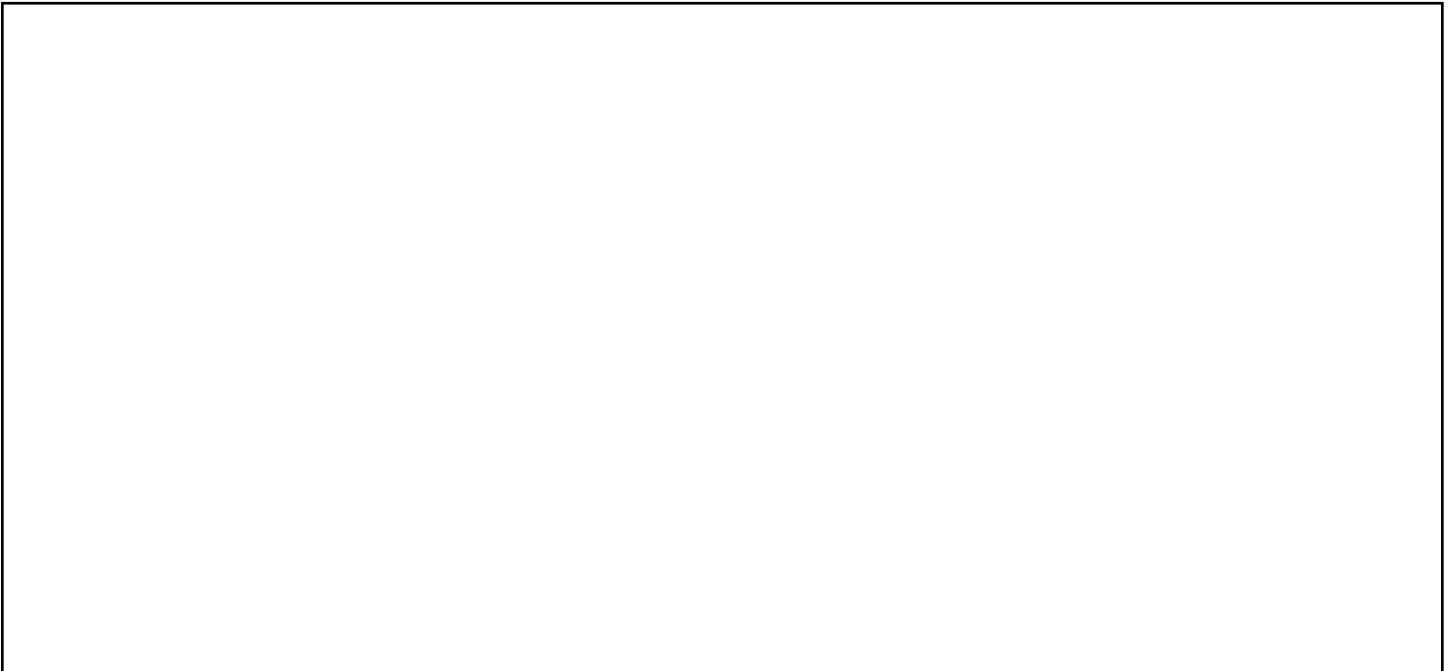
Additional Mass	0 grams	3 grams
Seconds to Fall		

Which mass was more successful? Why?

Plan

Work with your group to come up with a plan.

Draw the plan for your design below.



Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test 1

Blade perimeter: _____

Blade area: _____

How long did your first design take to fall? _____ seconds

Improve

What will your team improve about your design? Why?

Test 2

Blade perimeter: _____

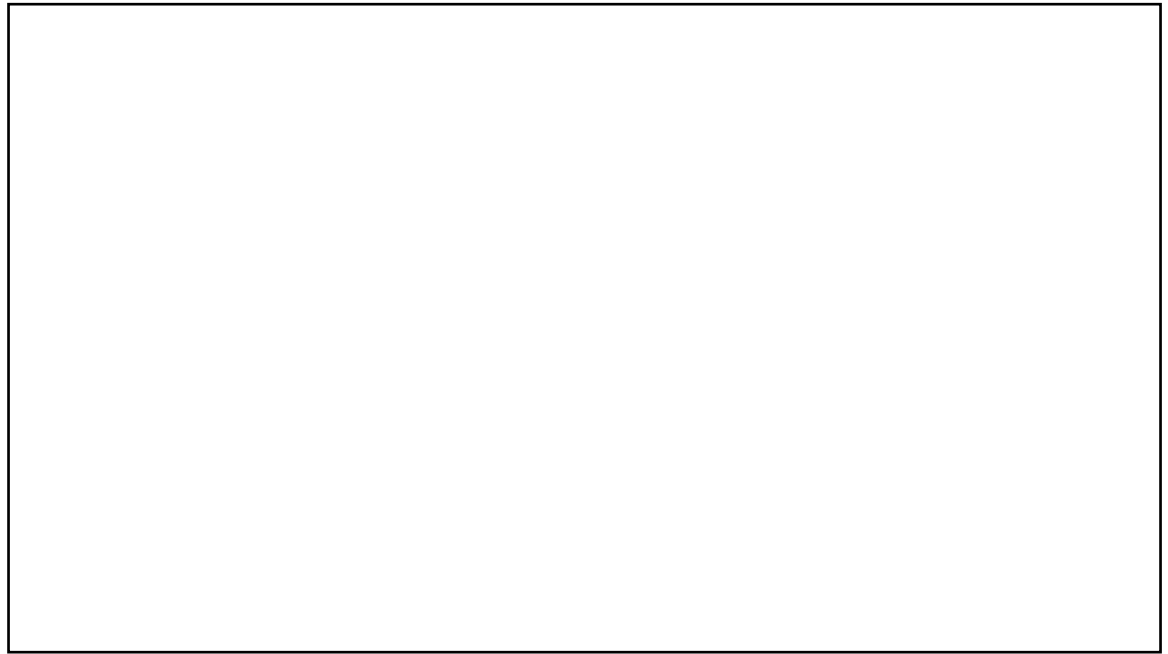
Blade area: _____

How long did your improved design take to fall? _____ seconds

Data Graph

Record the data from the first and second test below.

Seconds



Test 1

Test 2

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Design a Telephone

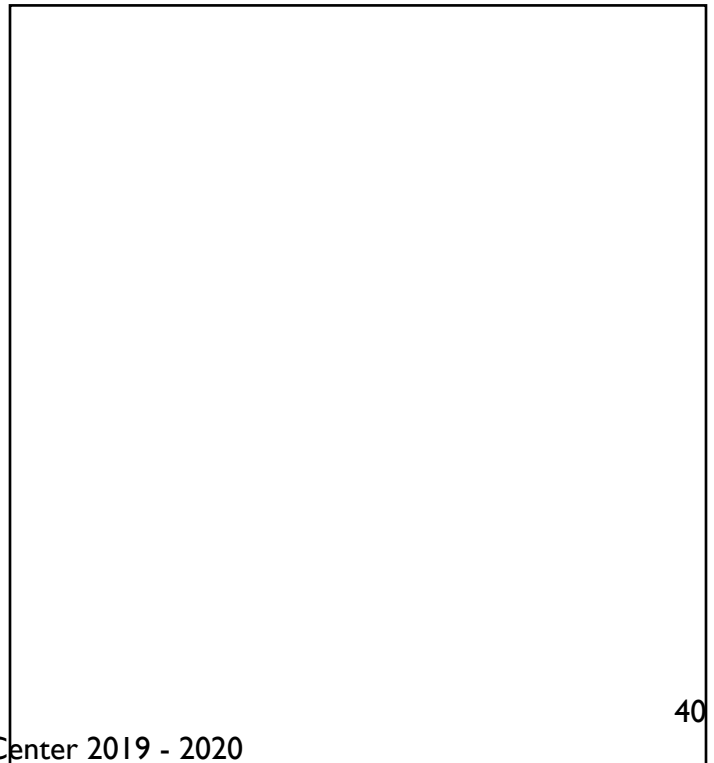
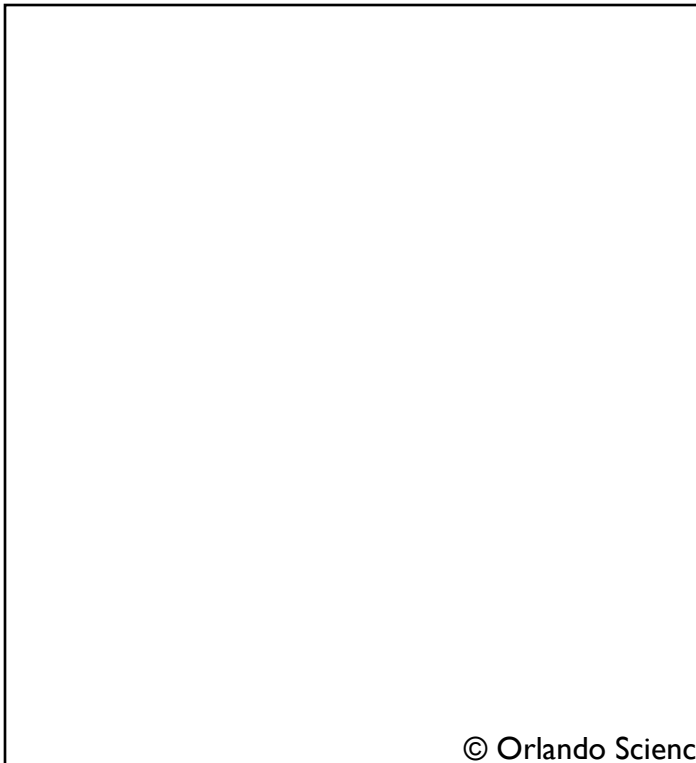
Goal: Design a telephone which will transfer sound clearly.

The sound must transfer _____ ft.

The telephone must transfer _____ words.

Imagine

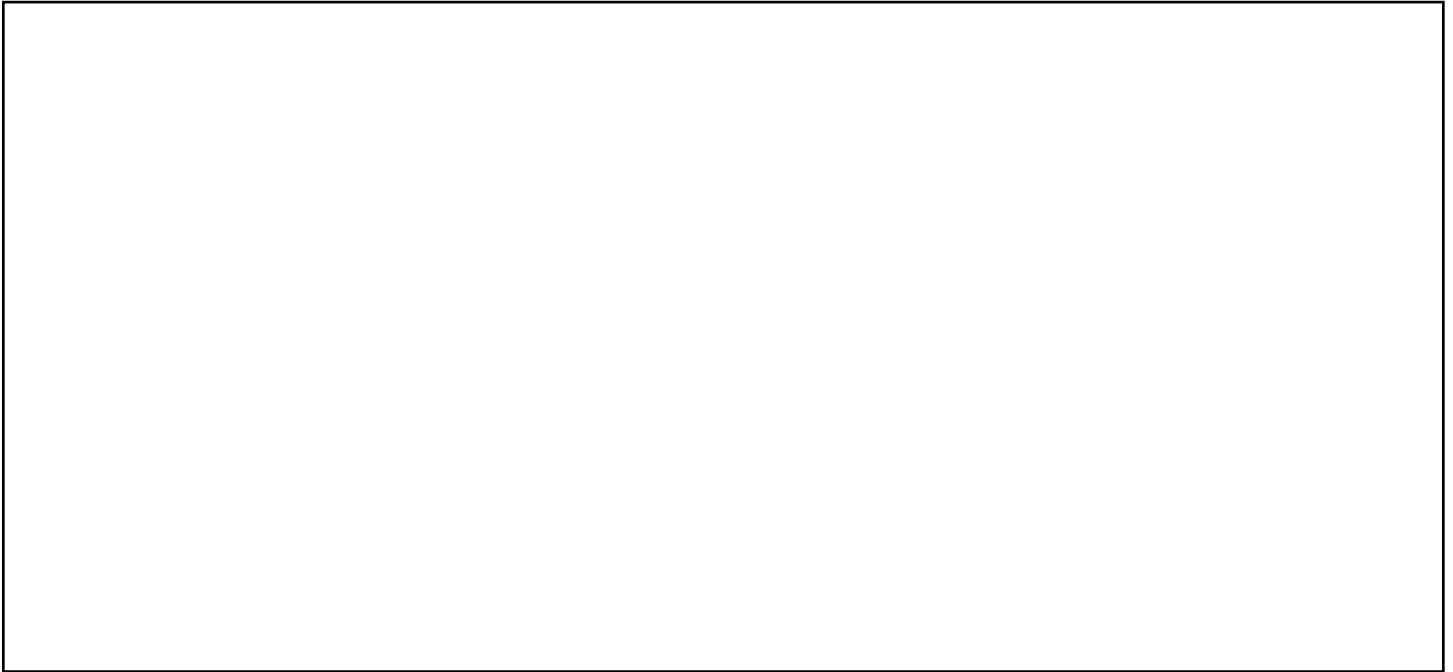
Draw two ideas below.



Plan

Work with your group to come up with a plan.

Draw the plan for your design below.



Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test 1

Words heard clearly: _____

Scored: ___ out of 10 words = ____%

Improve

What will your team improve about your design? Why?

Test 2

Words heard clearly: _____

Scored: ___ out of 10 words = ____%

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Hydroponics System

Goal: Design a hydroponics system which will transport water to a plant.

The design must transport at least ____ cups of water.

Imagine

How much water did each material absorb? (*Blank space is provided below to show your work.*)

Sponge	Paper Towel	Diaper

Write the materials in order from least to most absorbent:

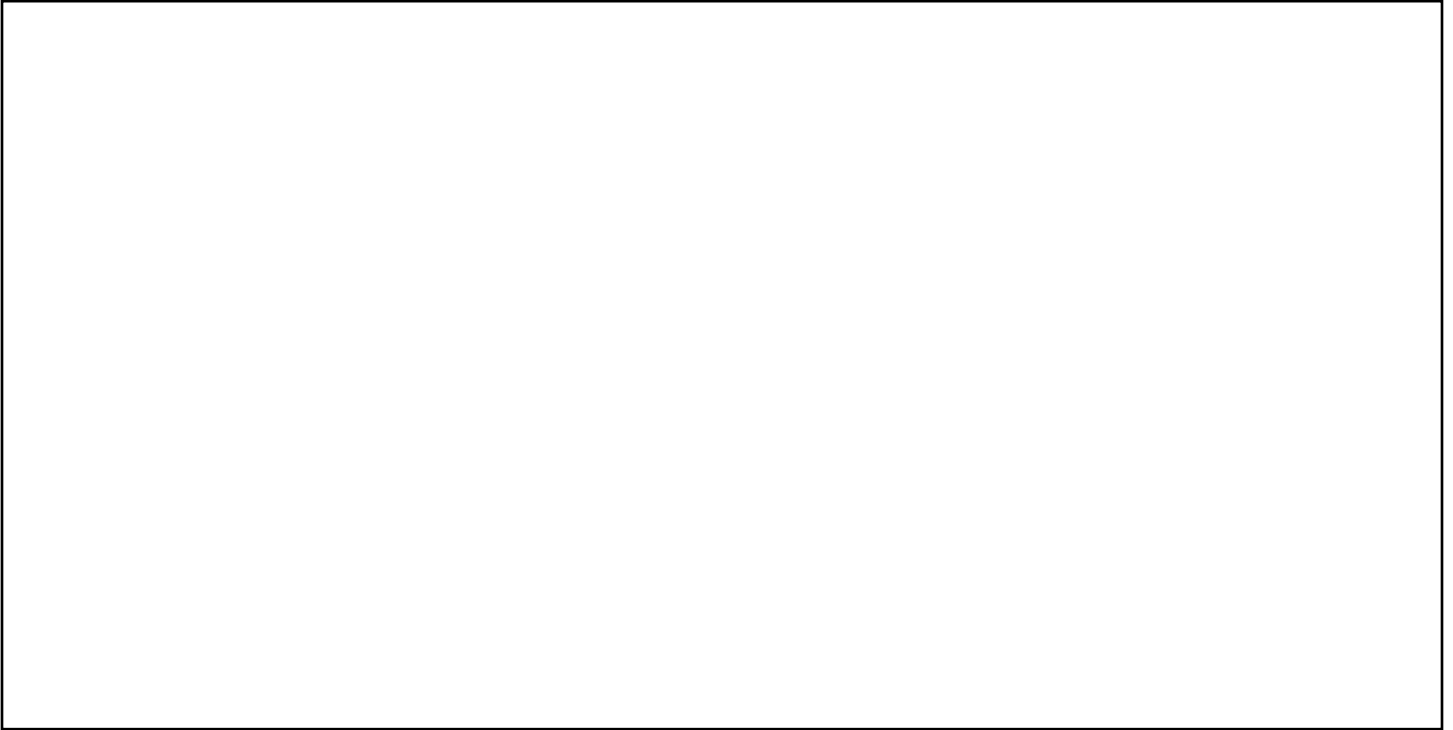
Budget

** Note: Unit cost is per one material unless noted otherwise

Material	Unit Cost	Quantity	Material Total Cost
Yarn, per foot	\$1		
String, per foot	\$1		
Sponge	\$5		
Paper towel	\$1		
Sock	\$3		
Coffee filter	\$1		
diaper	\$10		
Cotton ball, bundle of 5	\$5		
Felt 8 1/2" x 11"	\$1		
Fabric 8 1/2" x 11"	\$1		
Paper 8 1/2" x 11"	\$1		
Tissue paper 8 1/2" x 11"	\$1		
TOTAL COST (MAXIMUM \$30)			

Plan

Draw the plan for your design below.



Create

Here are the steps we followed to create our design:

1. _____

2. _____

3. _____

4. _____

5. _____

Test 1

How much water did your design absorb? _____

Did your design meet the goal? Why or why not?

Improve

What will your team improve about your design? Why?

Test 2

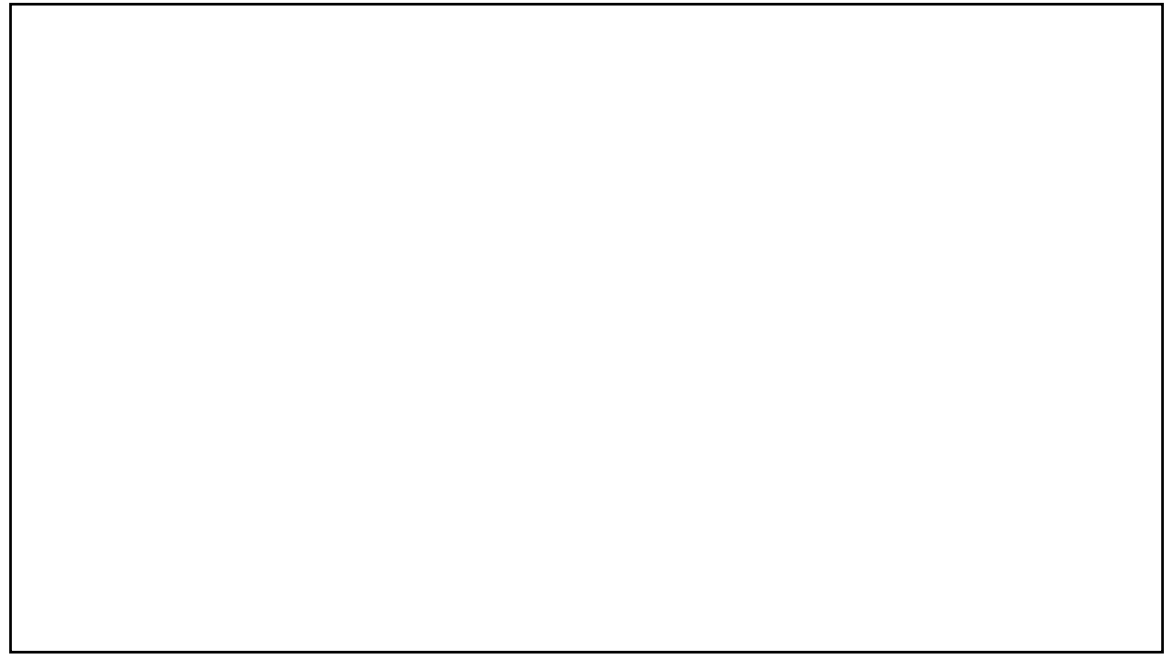
How much water did your design absorb? _____

Did your design meet the goal? Why or why not?

Data Graph

Record the data from the first and second test below.

Water
Volume
Absorbed



Test 1

Test 2

Reflect: Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?

Board Game Challenge

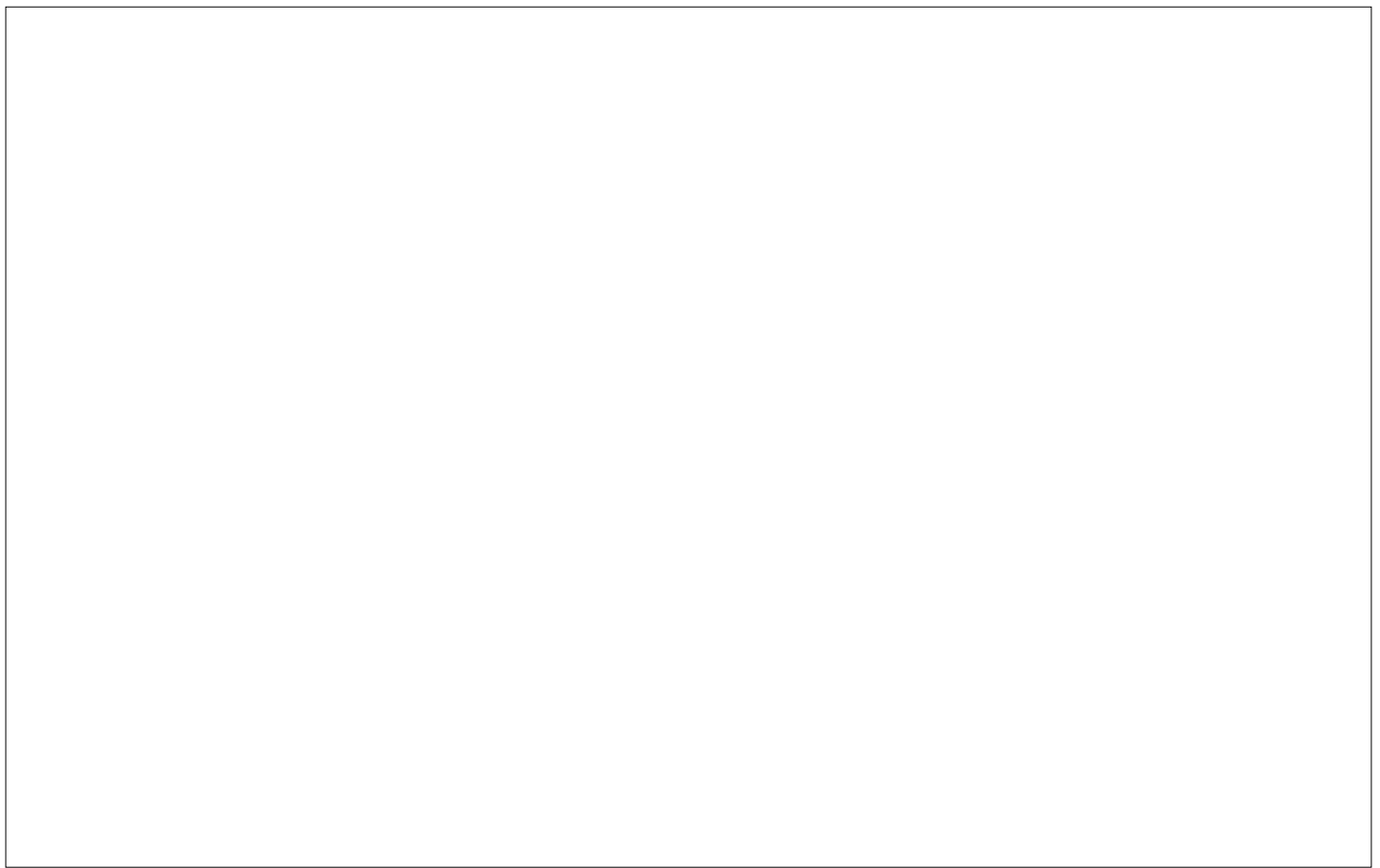
Goal: Design a board game that is both fun and engaging.

To be fun, the game board needs to have _____ square spaces measured in _____ and allow for _____ players to participate.

To be engaging, players must the following two types of math equations to move throughout the board.

Imagine:

Draw the game board you would design yourself:



Here are three math equations I would include:

Plan:

Work with your group to come up with a design.

Draw your group's game board design here.

Here are three multiplication equations we will include:

Create

Here are the steps we followed to create our design:

1.
2.

3. _____

4. _____

5. _____

Test I

How many spaces did your game board include? _____

How many players can participate? _____

Write down three multiplication and three addition equations included in the game below:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Improve:

What will your team improve about your design? Why?

Test 2

How many spaces did your game board include? _____

How many players can participate? _____

Write down three multiplication and three addition equations included in the game below:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Reflect:

Was your improved design more successful than your first design? How do you know?

How would you improve your design if there were time? Why?
