



Curtis Rising Stars 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 _____ tall.

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

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

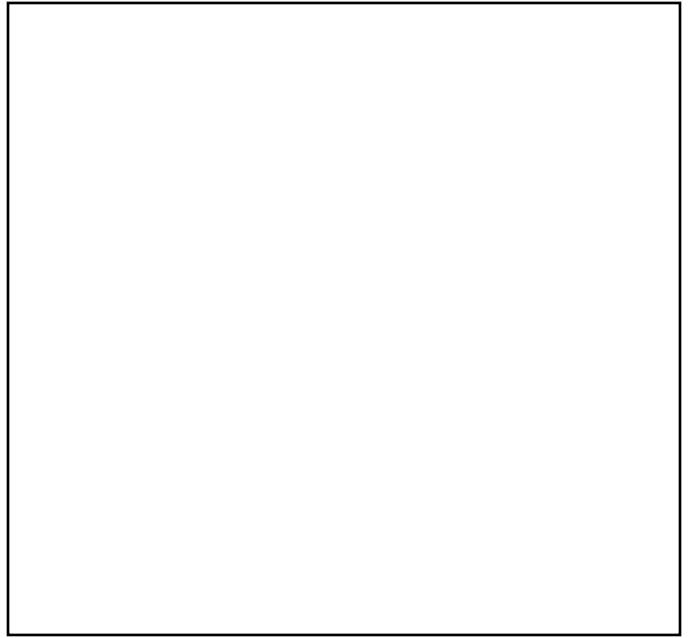
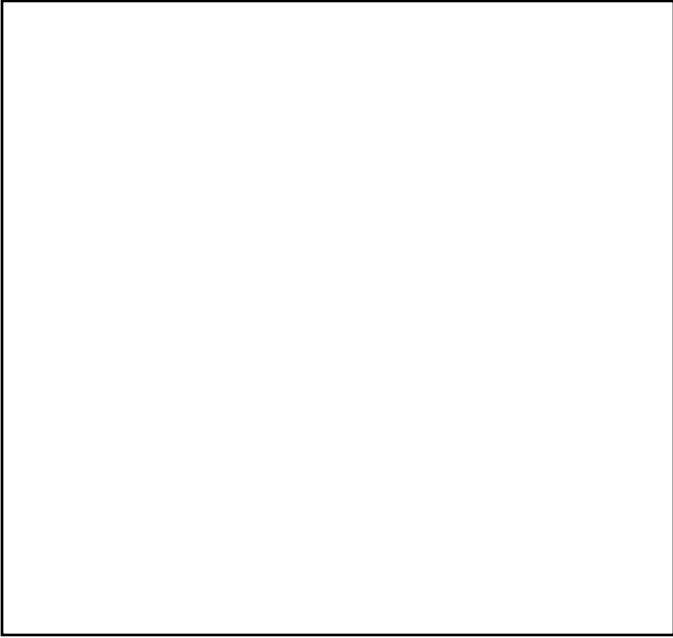
The measurement of the book my scaffolding system must support is:

Length: _____

Width: _____

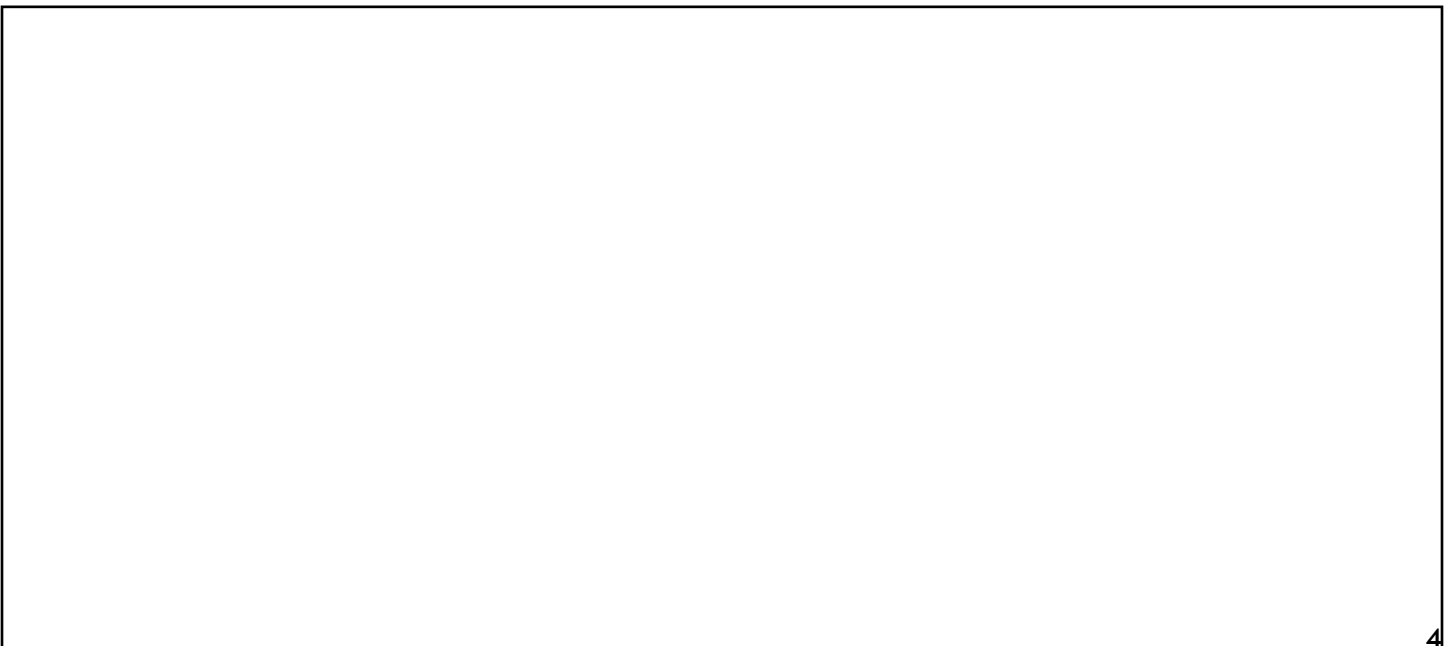
Imagine

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.

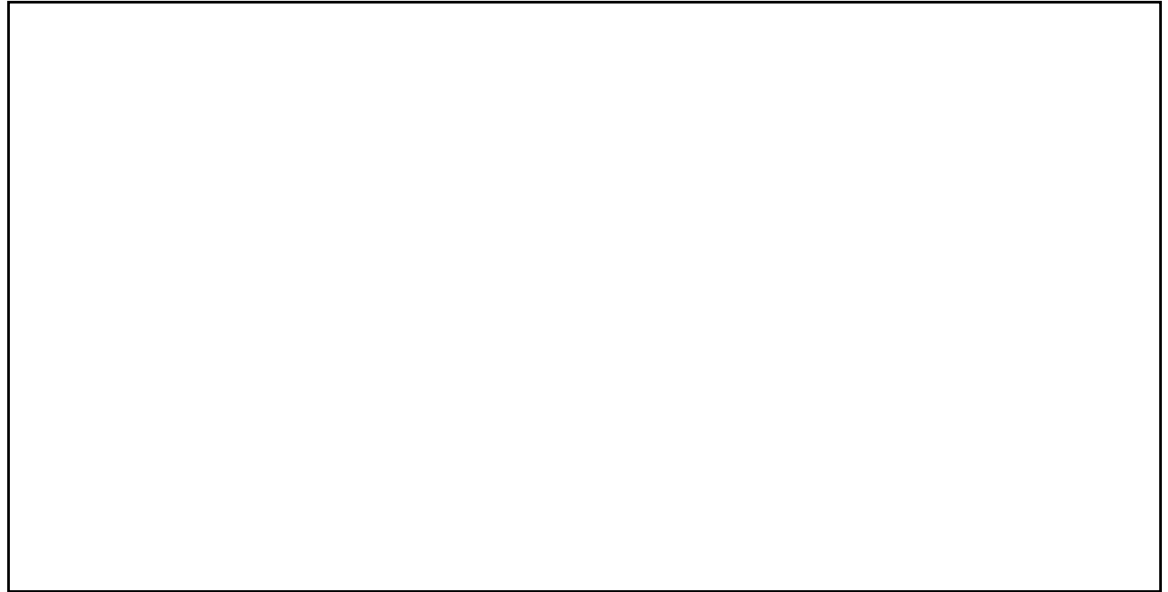
The total mass our improved design can support is: _____ .

Data Graphs

Record the data from the first and second tests on the graphs below.

Height

Height

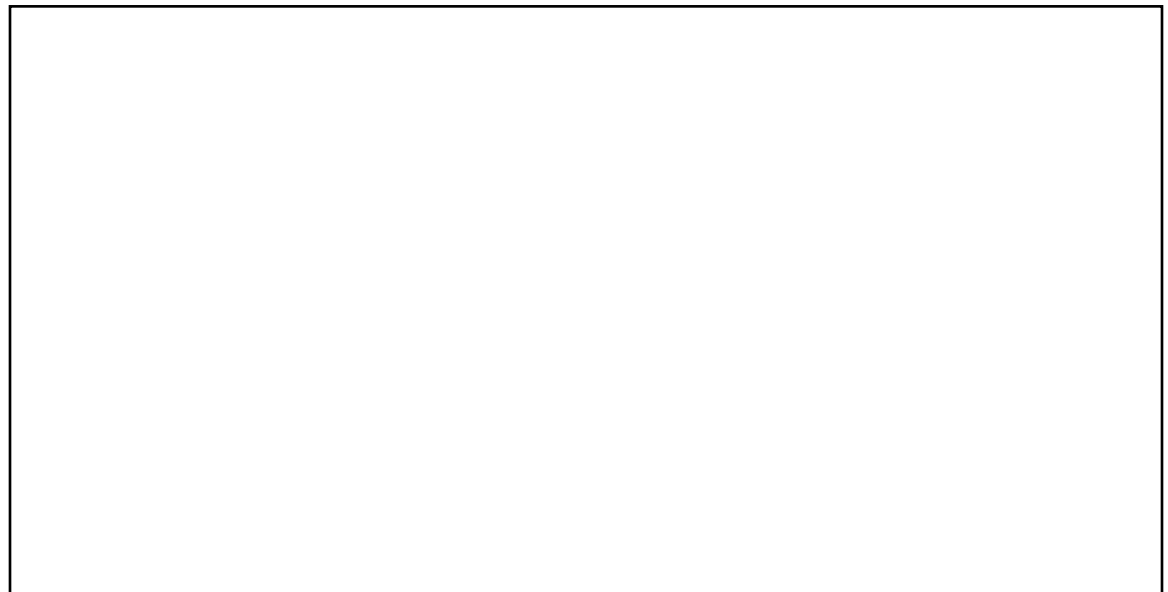


Test I

Test I

Strength

Mass
supported



Test I

Test I

Reflect

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

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

Design a Roller Coaster

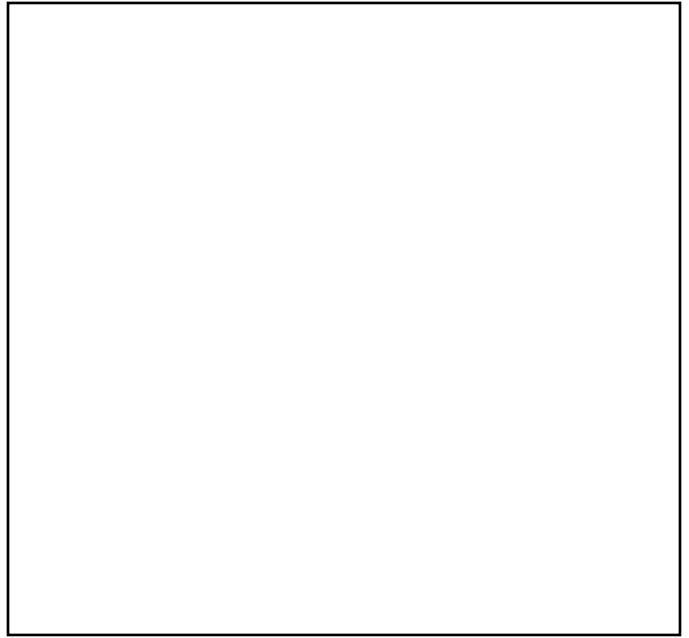
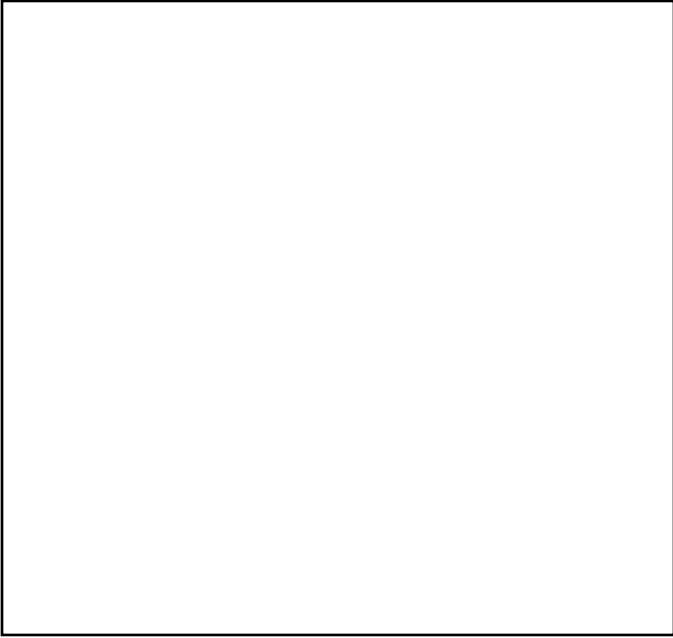
Goal: Design a roller coaster.

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

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

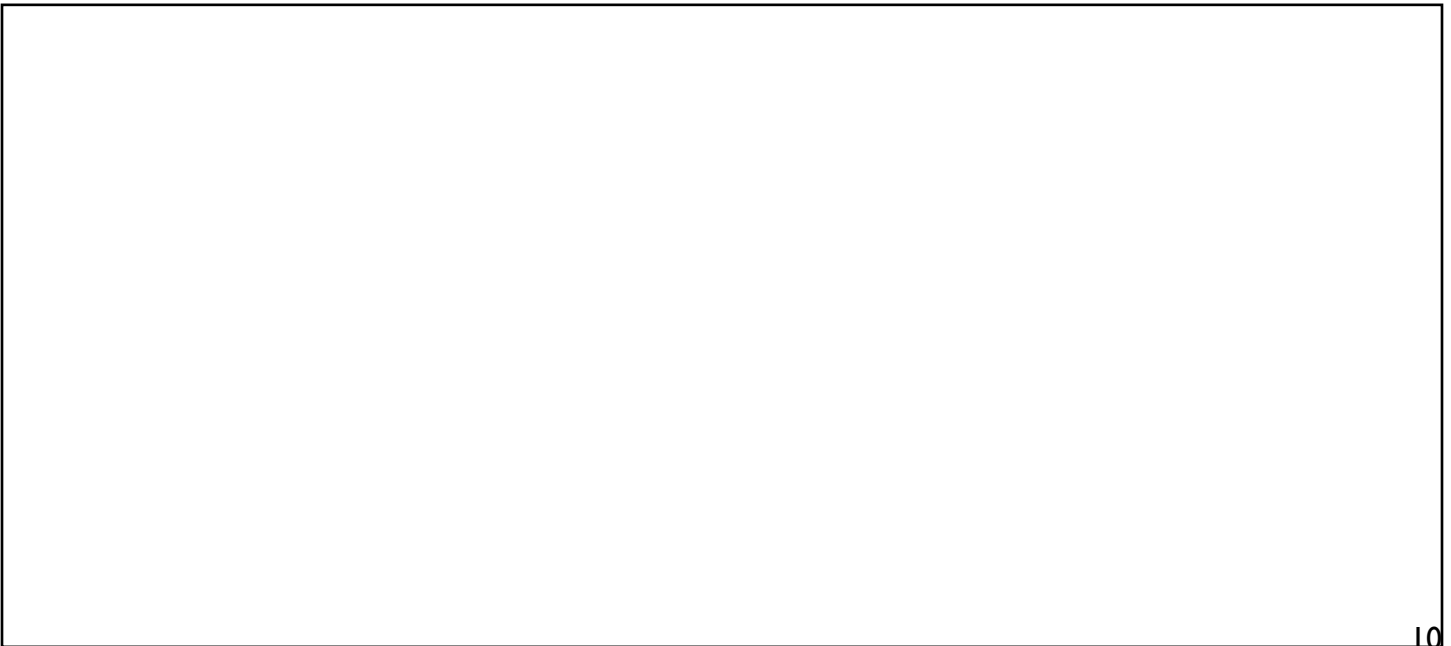
Imagine

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 length of our roller coaster track is: _____ .

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

$$\begin{array}{ccccccc} \underline{\hspace{2cm}} & = & \underline{\hspace{2cm}} & \div & \underline{\hspace{2cm}} \\ \text{Speed} & & \text{Distance} & & \text{Time} \end{array}$$

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 _____.

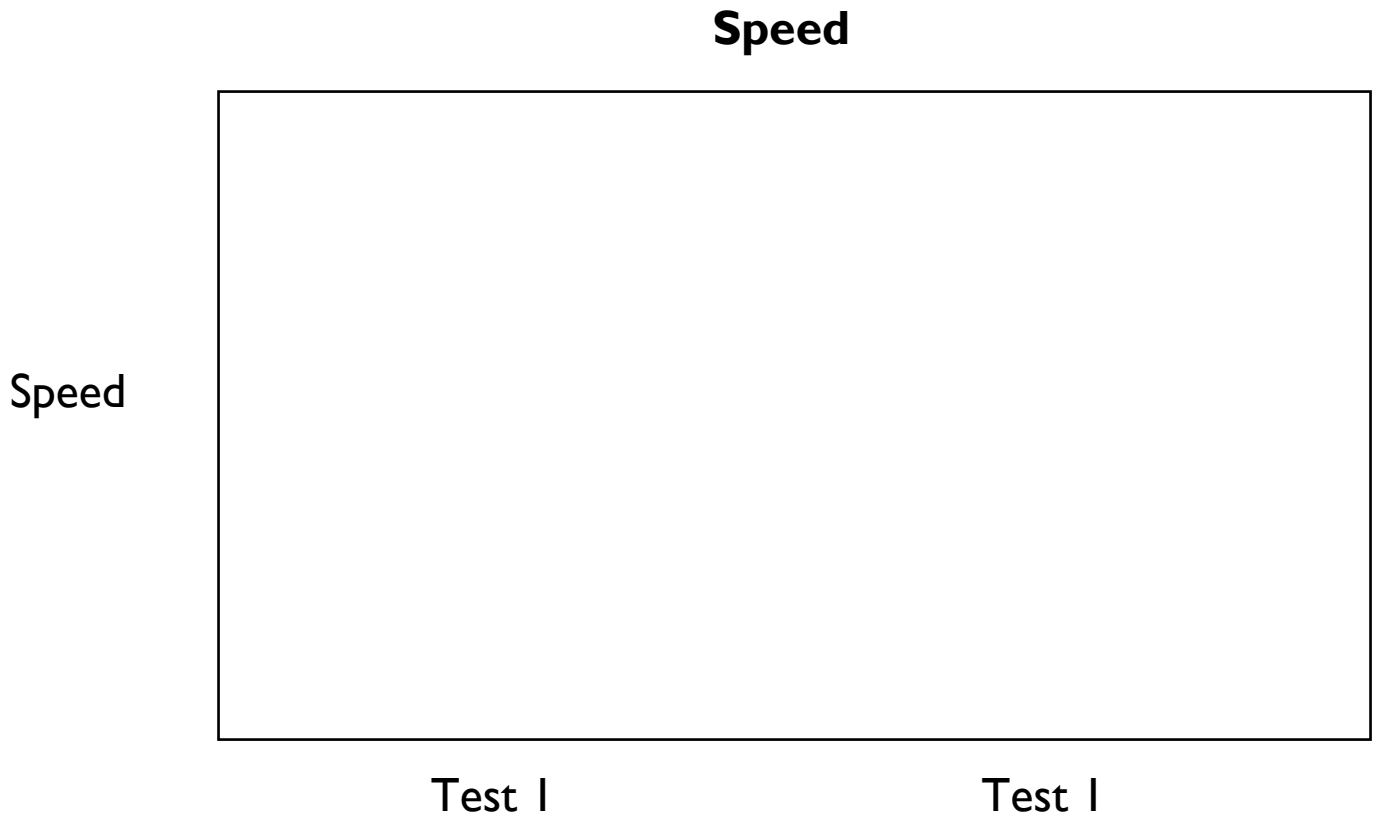
$$\begin{array}{ccccccc} \text{_____} & = & \text{_____} & \div & \text{_____} \\ \text{Speed} & & \text{Distance} & & \text{Time} \end{array}$$

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

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

Data Graph

Record the data from the first and second tests on the graph below.



Reflect

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

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

Design Play Dough

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

Record your observations of the high-quality play dough in the first column of the chart below. Record your observations of the low-quality play dough in the last column of the chart.

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 below.

- 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 this.

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 ingredient?

- 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 was time? Why?

Water Runoff Reduction System

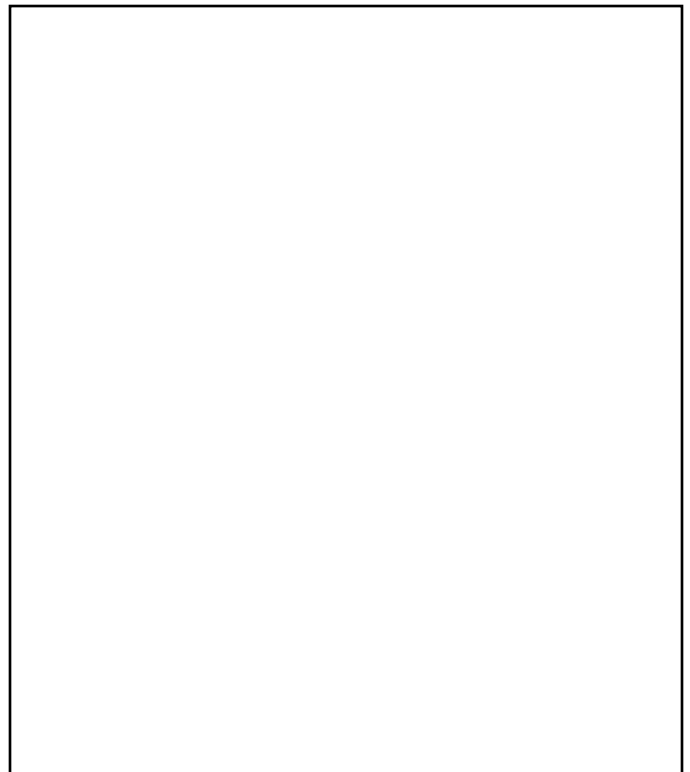
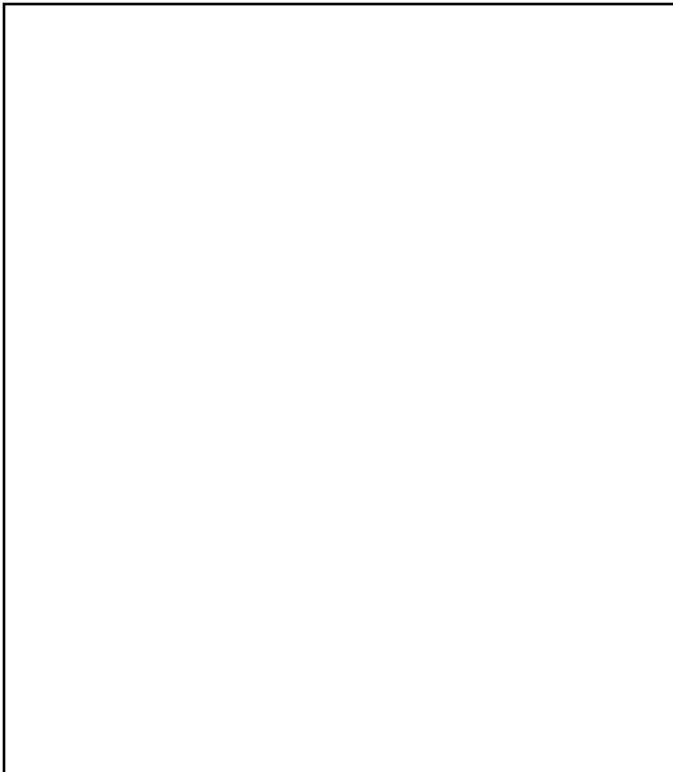
Goal: Design a system which will reduce water runoff from an urban landscape into a nearby lake.

Original lake level: _____ cm

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

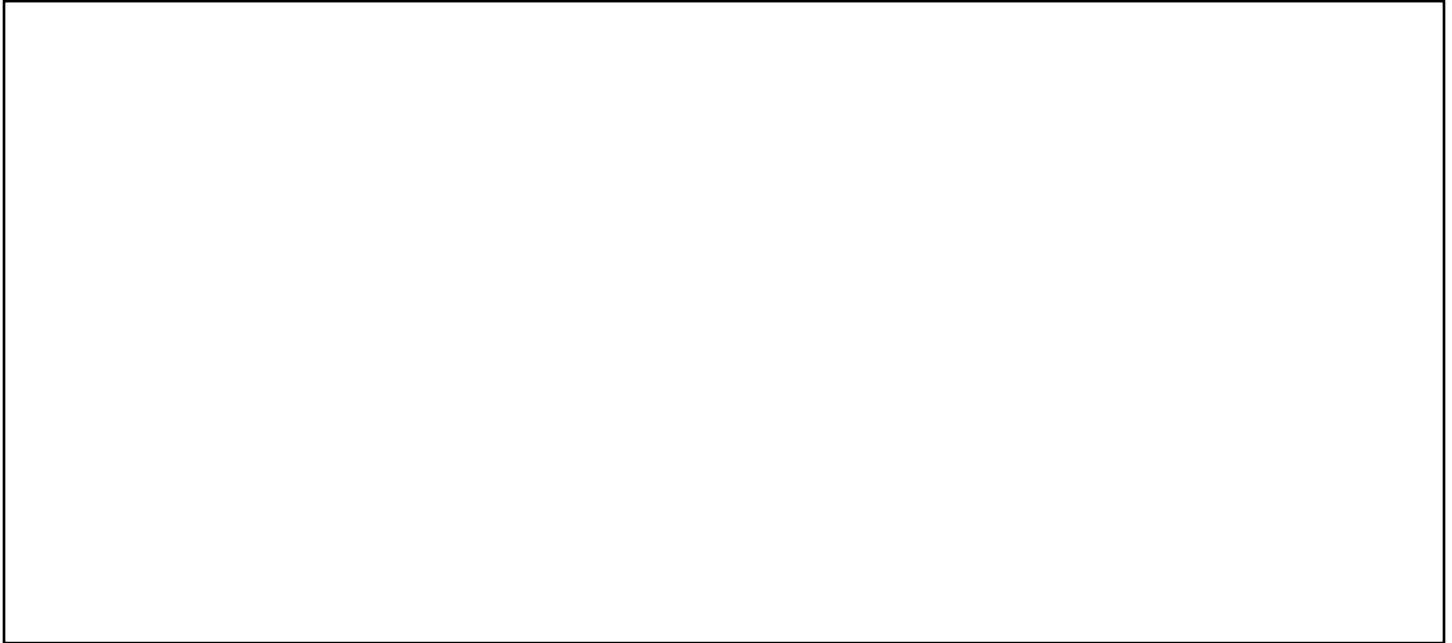
Imagine

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?

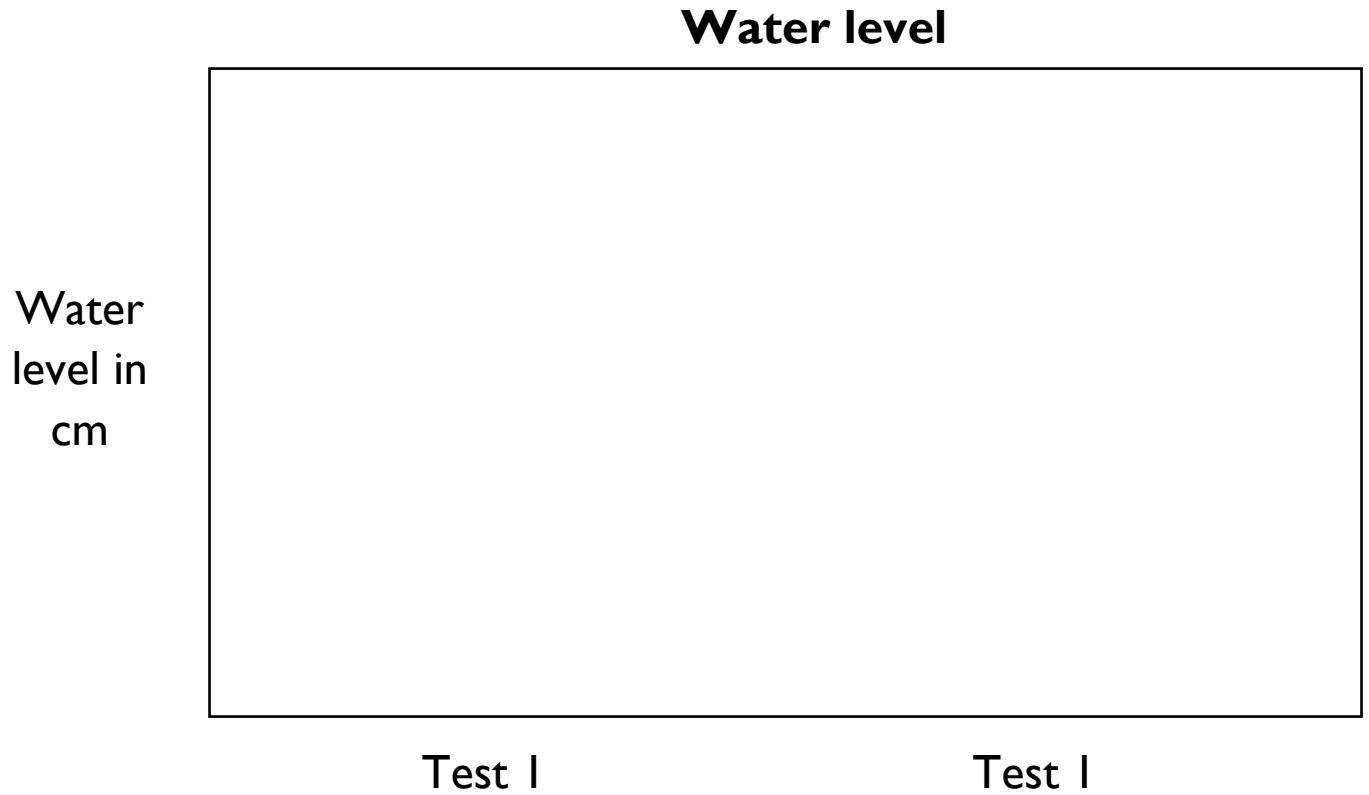
Test 2

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 in the graph below.



Reflect

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

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

Create a Zip Line

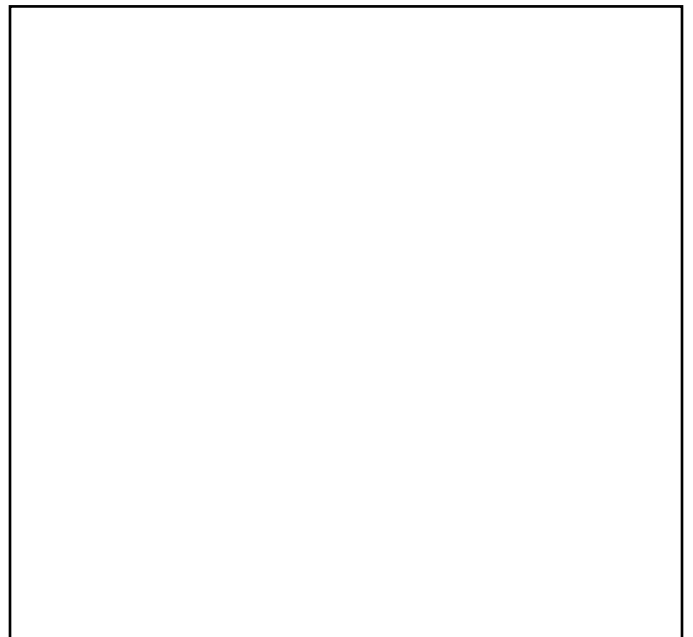
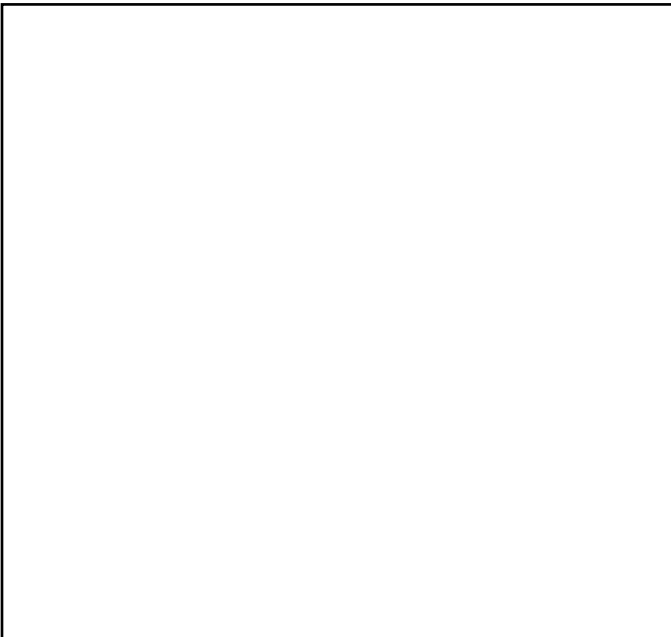
Goal: Design a container which can transport a company's products using a zip line to a town on the other side of a protected forest.

Distance: _____

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

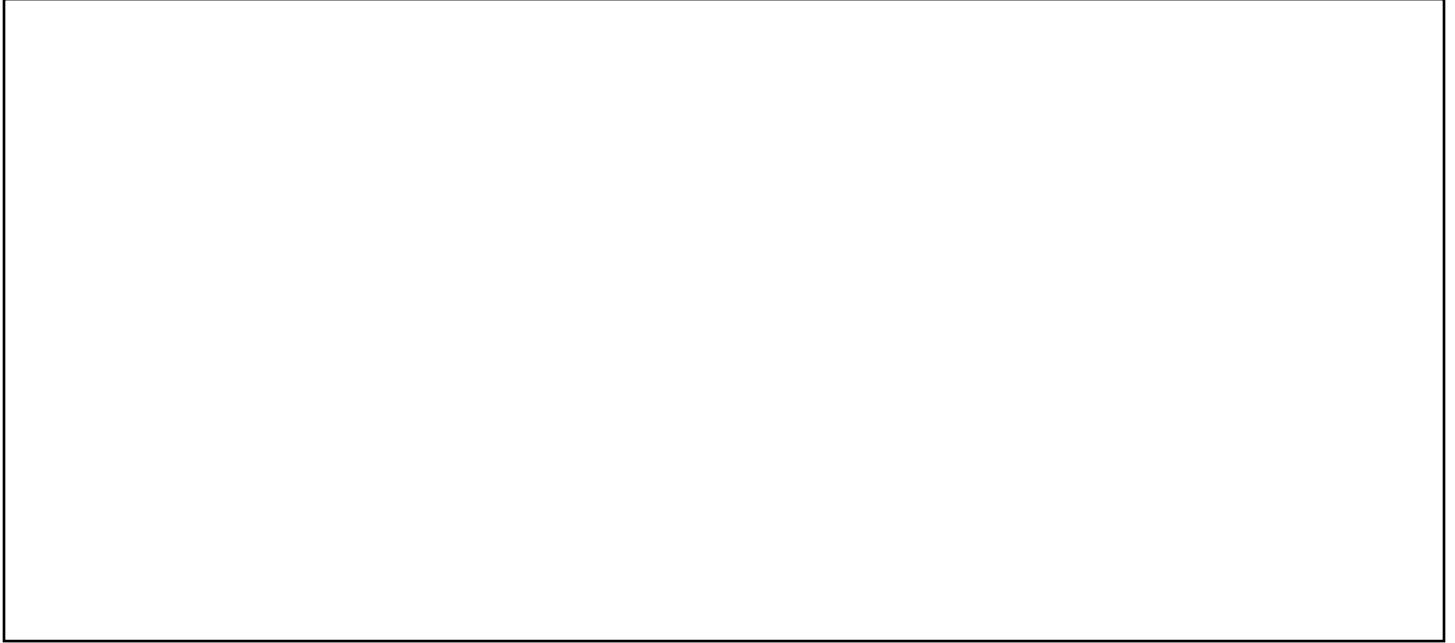
Imagine

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.



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

☐ Small paper cup	☐ Plastic cup
☐ Large paper cup	☐ Paper
☐ Index card	☐ Yarn, 12 in.
☐ Wax paper, 12 in. x 12 in.	☐ Aluminum foil 12 in. x 12 in.
☐ Paper clip	☐ Masking tape, 12 in.

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 your data on the distance number line.

- ☐ 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.

Improve

What will your team improve about your design? Why?

Test 2

Check off the criteria your group met. Record your data on the distance number line.

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

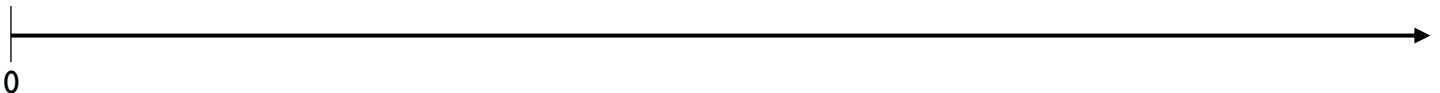
The distance our container traveled is: _____ .

- ☐ 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 was time? Why?

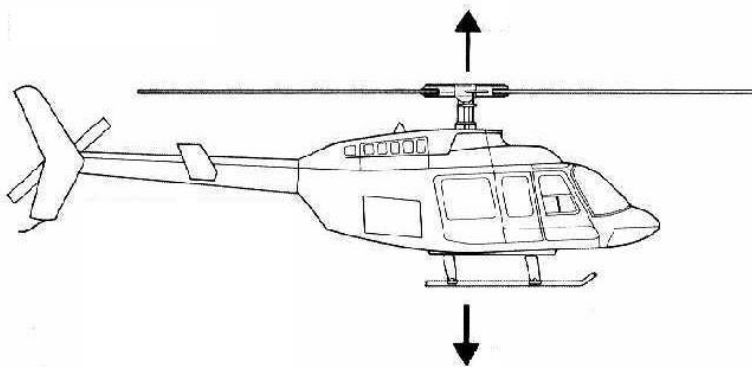
Design a Paper-Copter

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

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	Large
	Perimeter: Area:	Perimeter: Area:
Seconds to Fall		

Which size blade was more successful? Why?

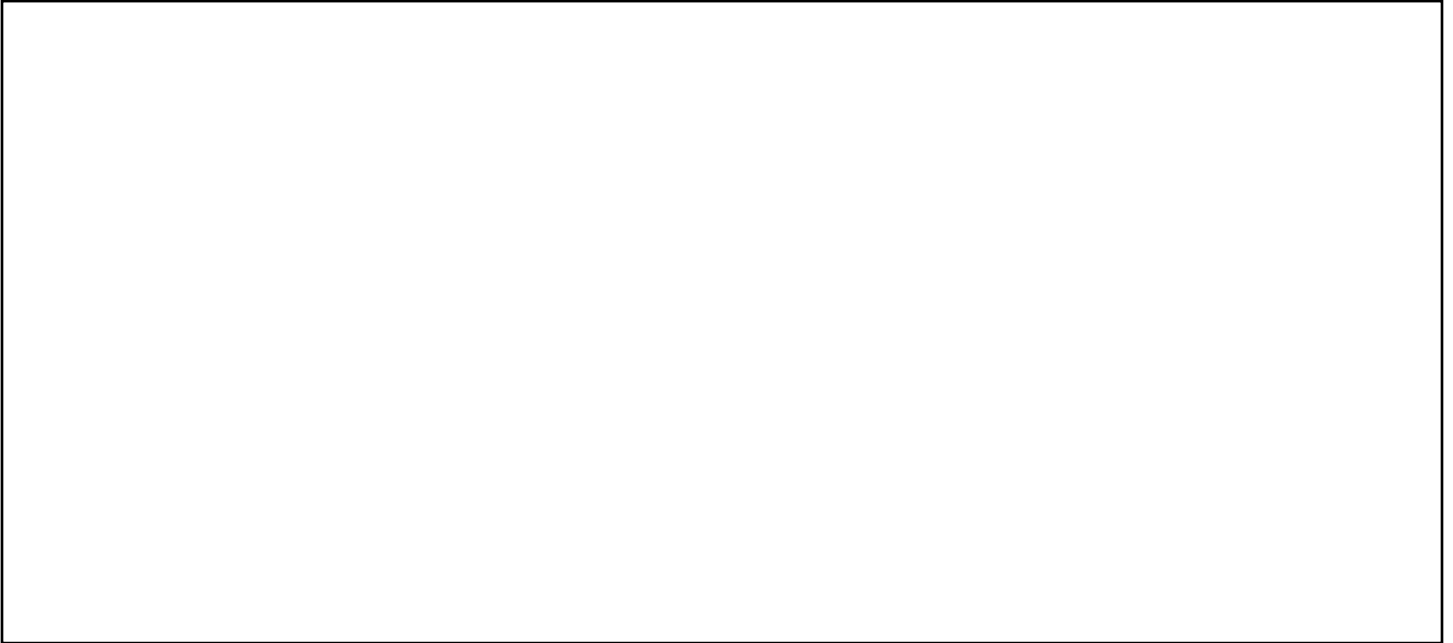
Mass Test:

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: _____

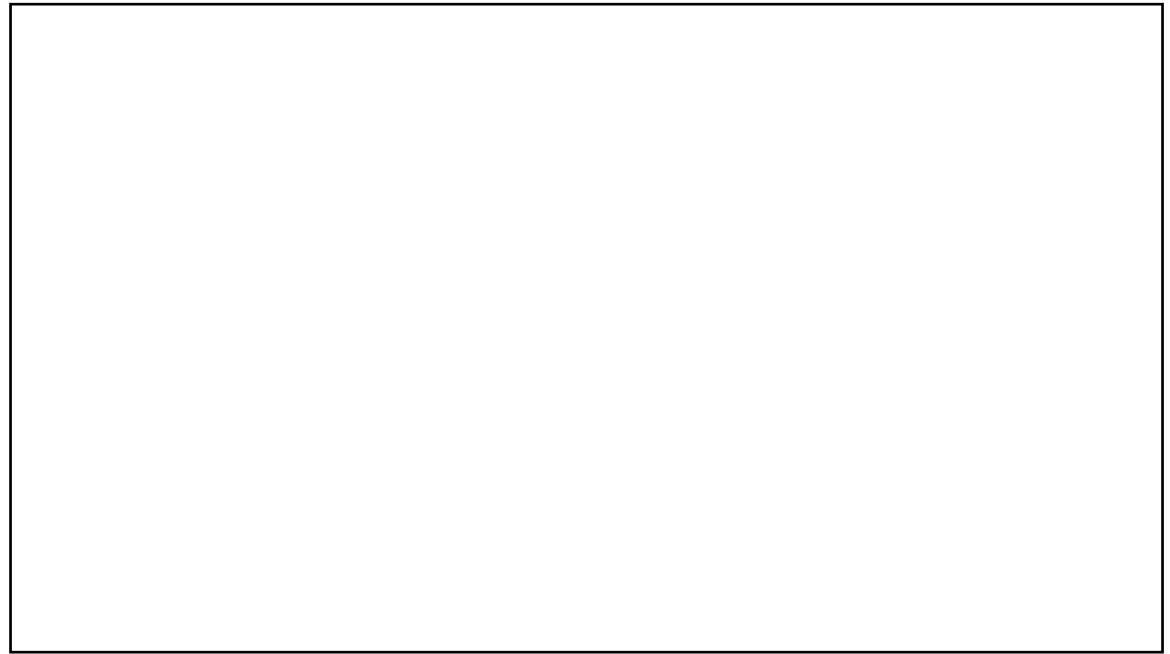
Blade area: _____

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

Data Graph

Record the data from the first and second test below.

Seconds
it took
the
paper-
copter to
fall



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 was time? Why?

Design a Telephone

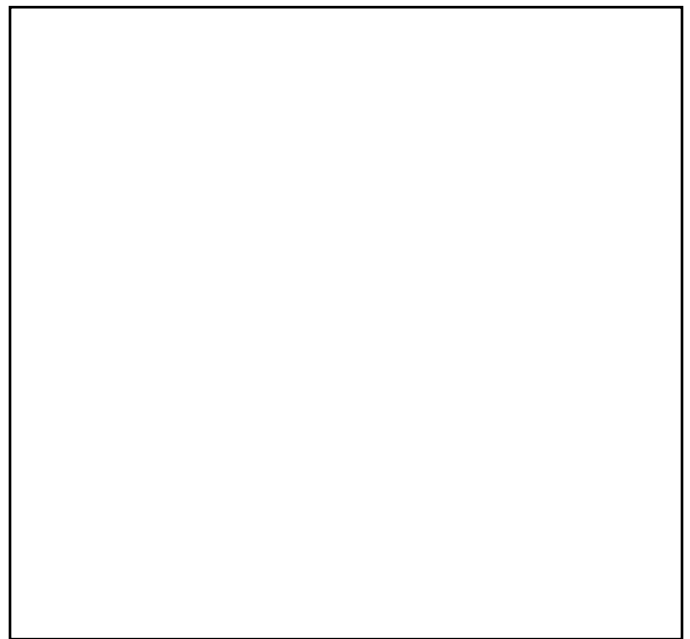
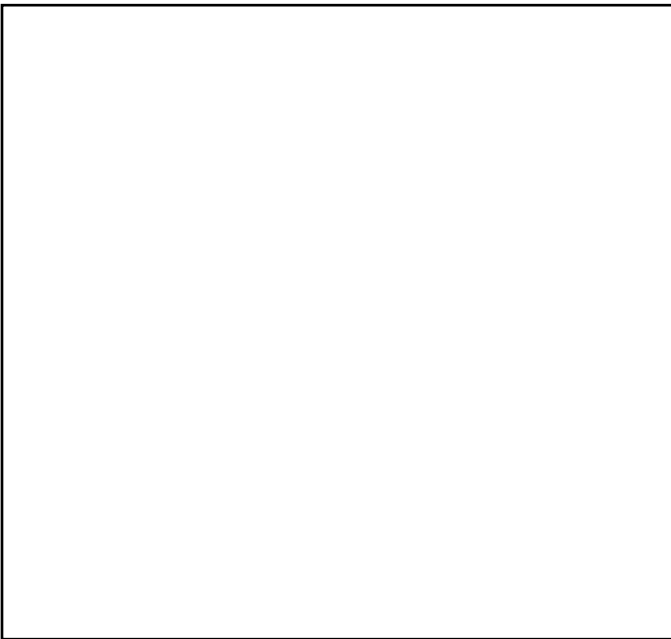
Goal: Design a telephone which will transfer sound clearly.

The sound must transfer _____ feet.

The telephone must transfer _____ words.

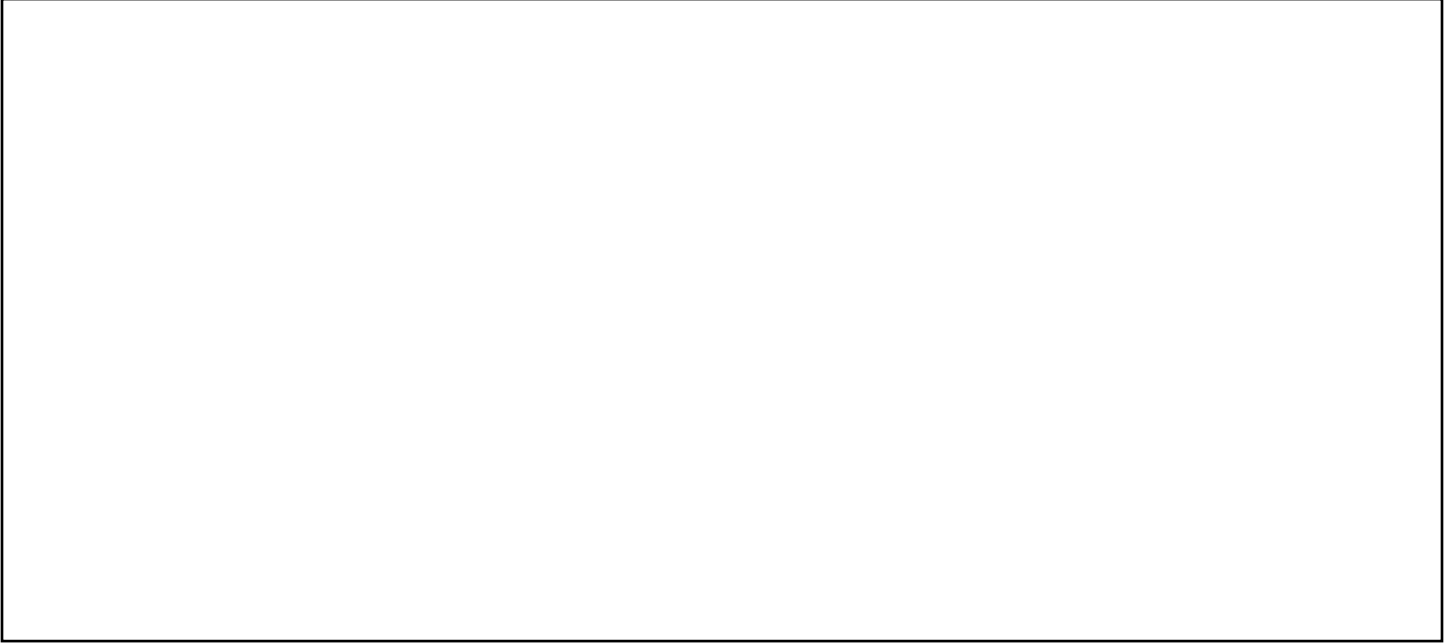
Imagine

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 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 was 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:

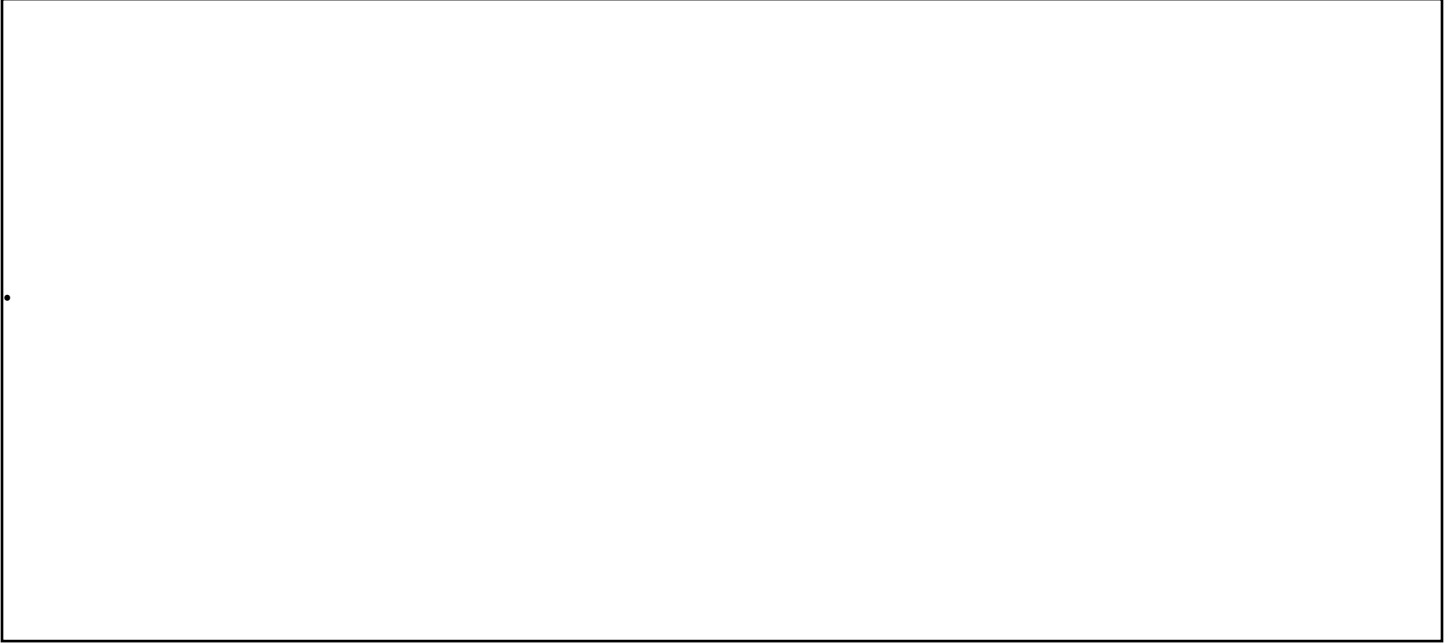
Budget

** 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 balls (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

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

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

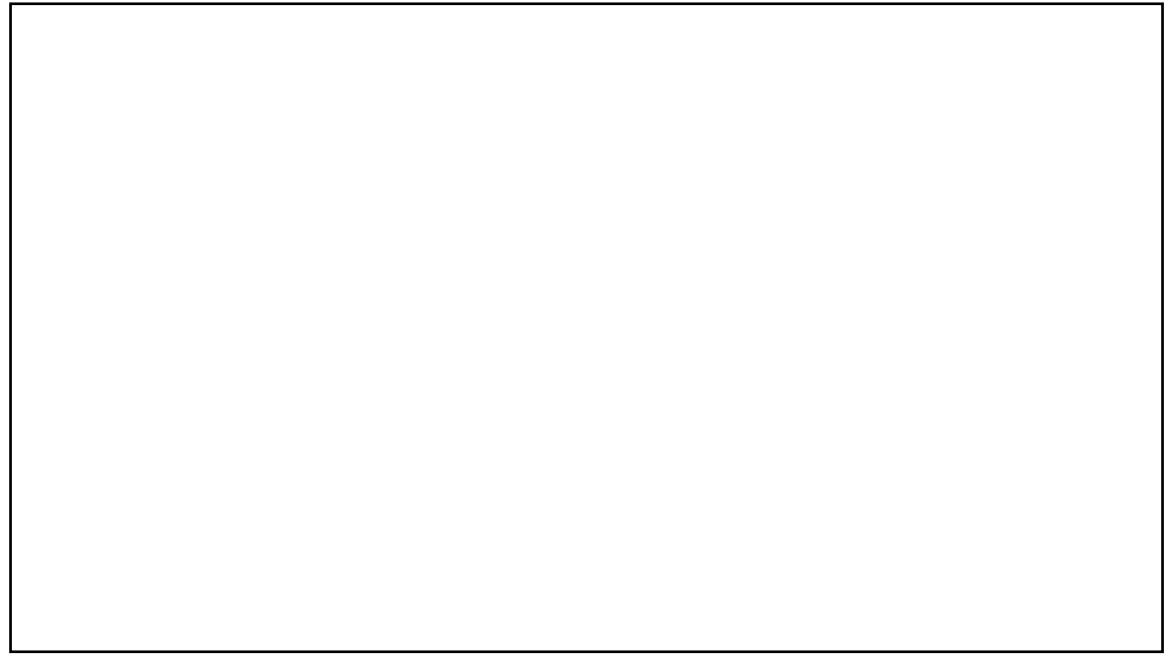
How much water did your design absorb? _____

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 was time? Why?

Board Game Challenge

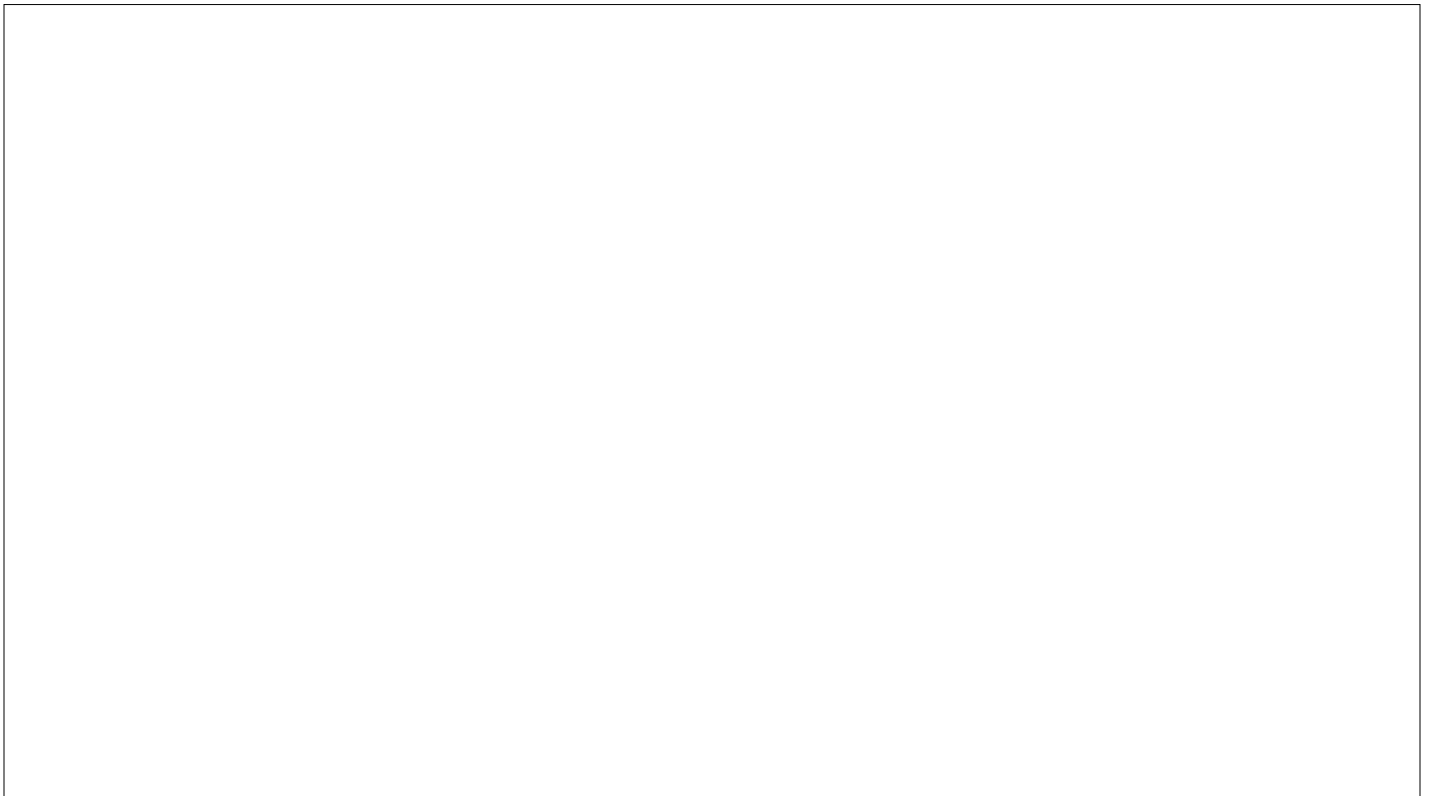
Goal: Design a board game that is both fun and engaging.

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

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

Imagine

Draw the game board you would design yourself:



Plan

Work with your group to come up with a design. Draw your group's game board design below.

Create

Here are three addition and three multiplication equations we are including in our game design:

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

Test I

How many spaces did your game board include? _____

How many players can participate? _____

How many addition equations are in your game? _____

How many multiplication equations are in your game? _____

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? _____

How many addition equations are in your game? _____

How many multiplication equations are in your game? _____

Reflect

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

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