ORLANDO SCIENCE CENTER

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…

_____

_____

_____

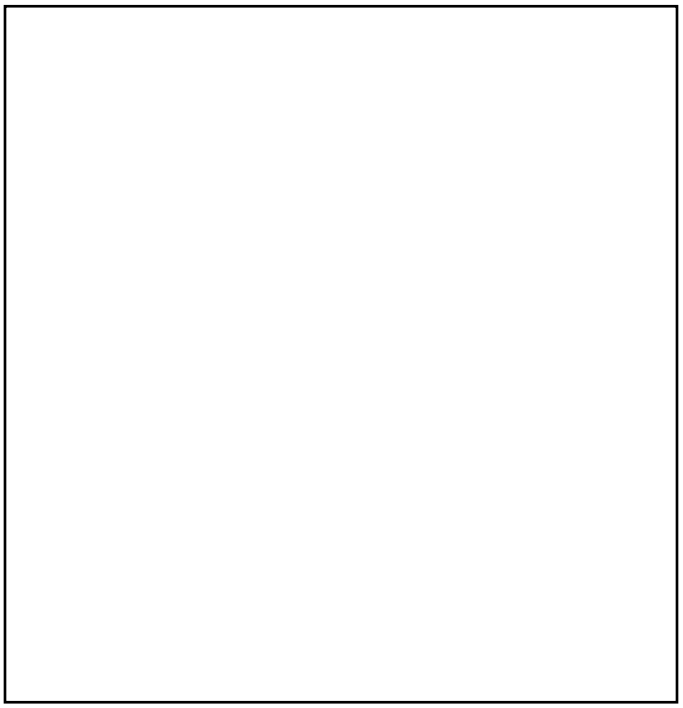
The measurement of the book my scaffolding system must support is:

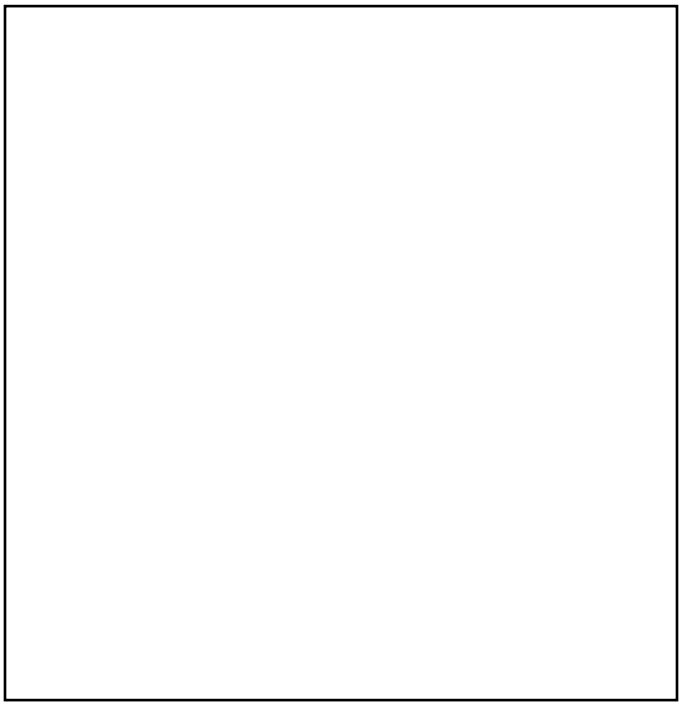
Length: _____

Width: _____

Imagine

Imagine at least two solutions to the problem.

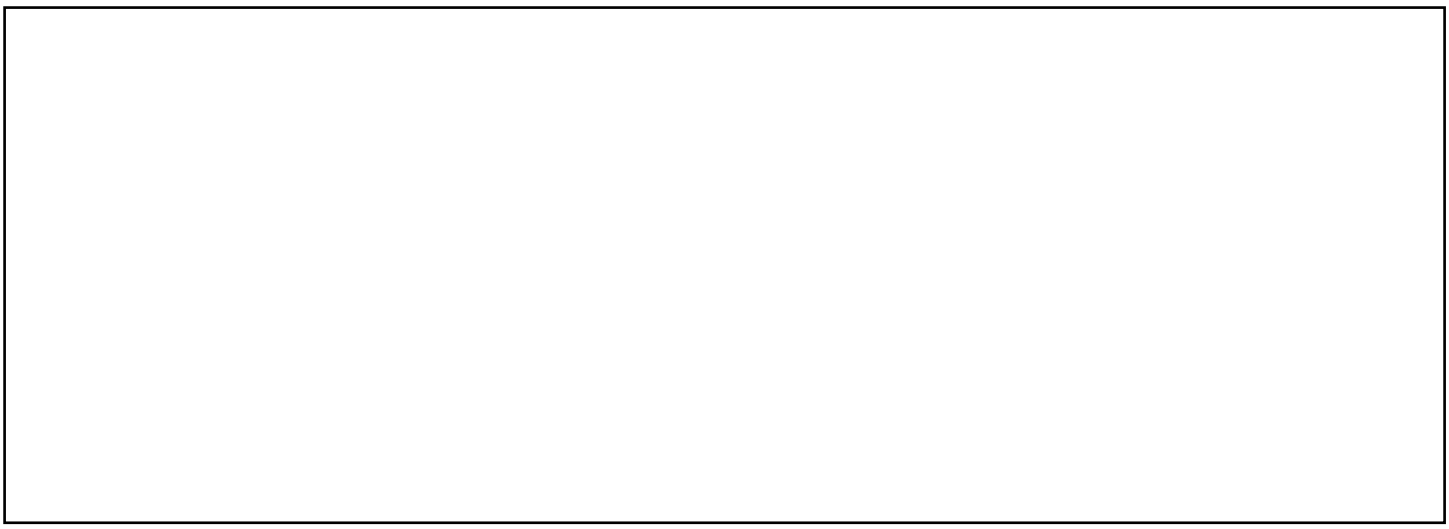




Plan

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 1

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.

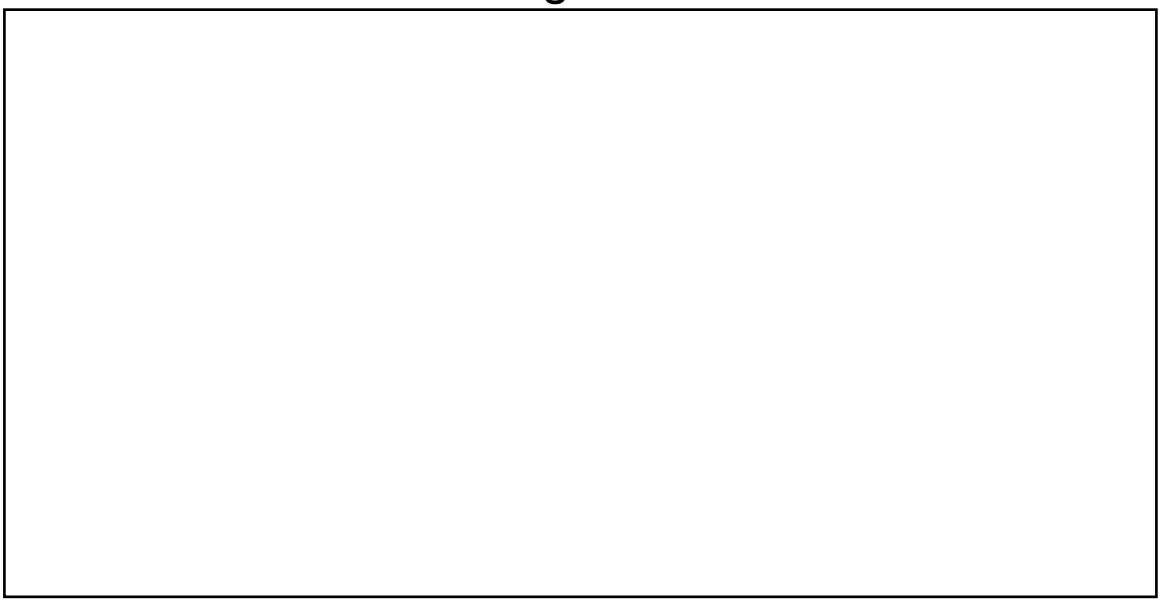
The total mass our improved design can support is: _____.

Data Graph

Record the data from the first and second test below.

Height

Height

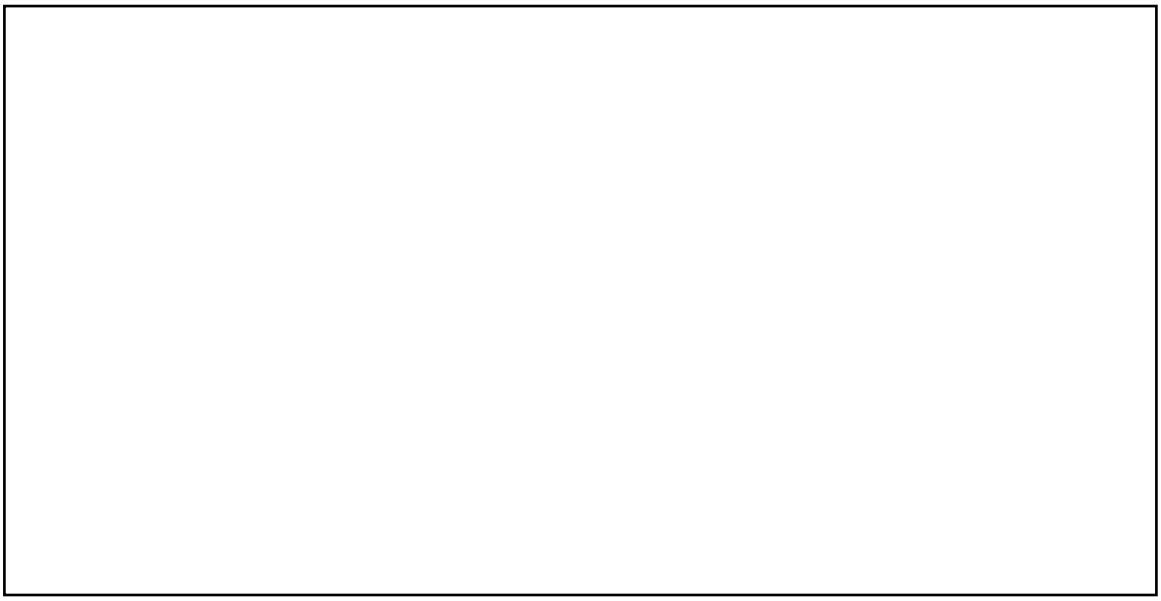


Test 1

Test 2

Mass supported

Strength



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 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.

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

The length of our roller coaster track is: _____.

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

_____ = _____ ÷ _____

Speed Distance 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.

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 _____.

_____ = _____ ÷ _____
Speed Distance Time

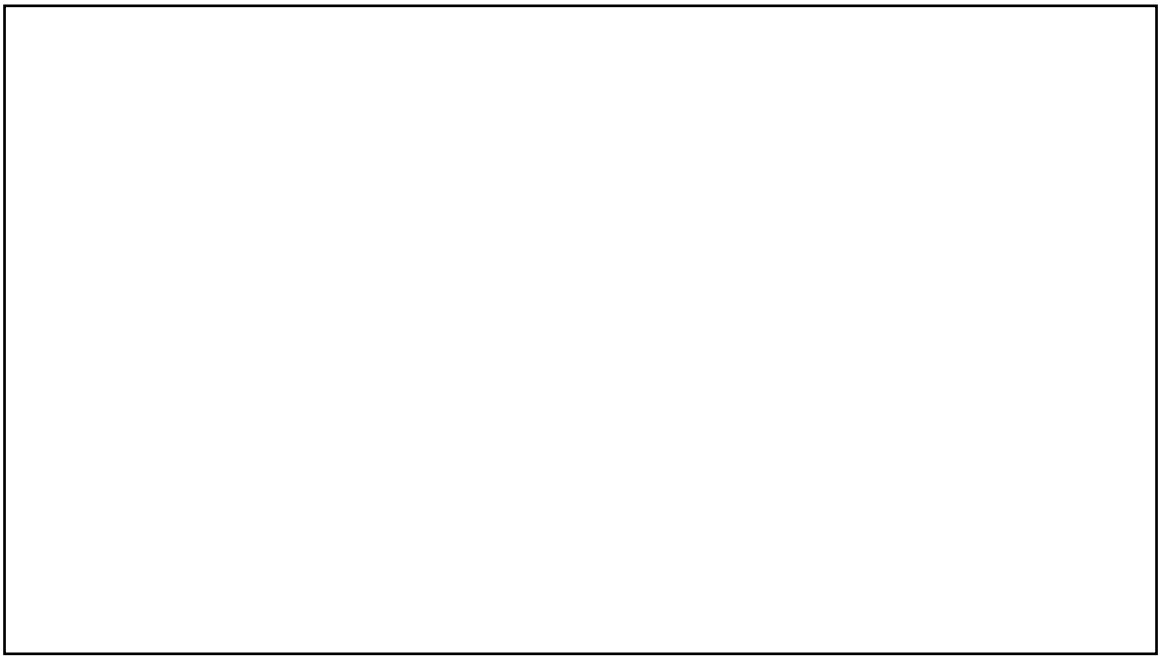
Check off the criteria your group met. Record test data on your graph.

- ☐ 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 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 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 ½ 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 1

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 1

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

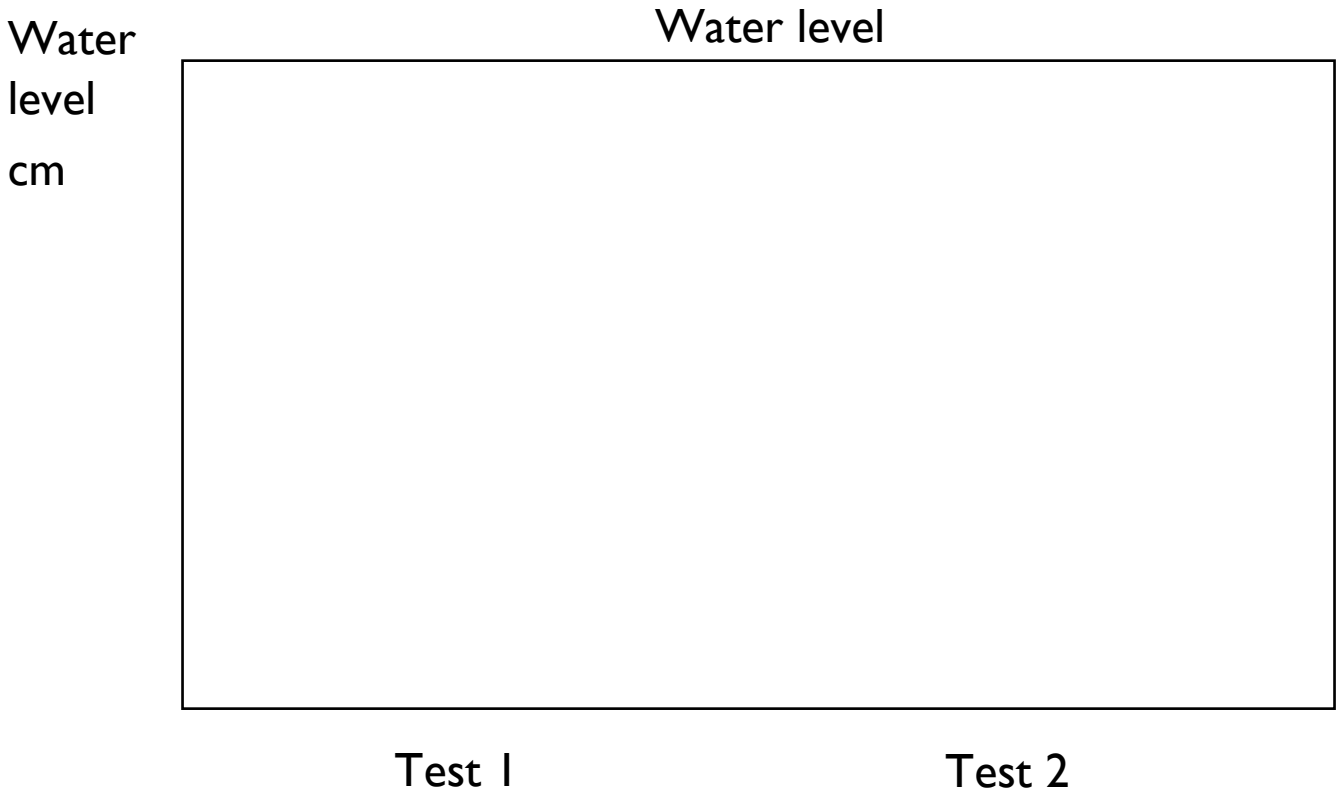
Water level after rain: _____ cm

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.

☐ 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 1

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

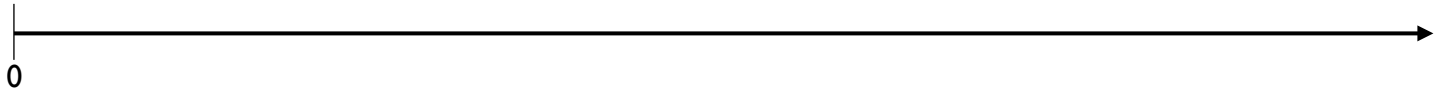
Check off the criteria your group met. Record test data on your graph.

- ☐ 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?

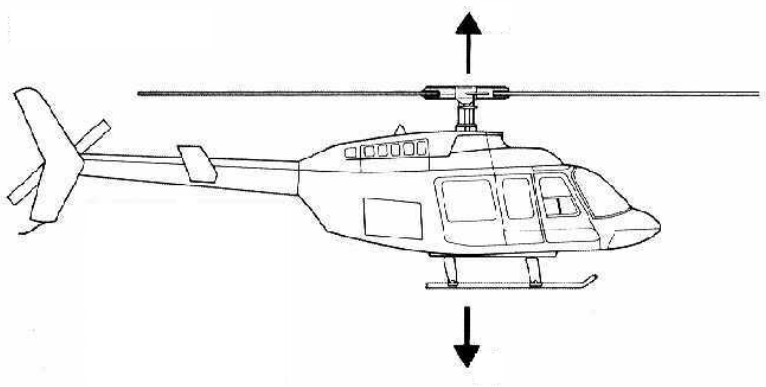
Design a Paper-Copter

Goal: Design a paper-copter which will <u>drop</u> 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

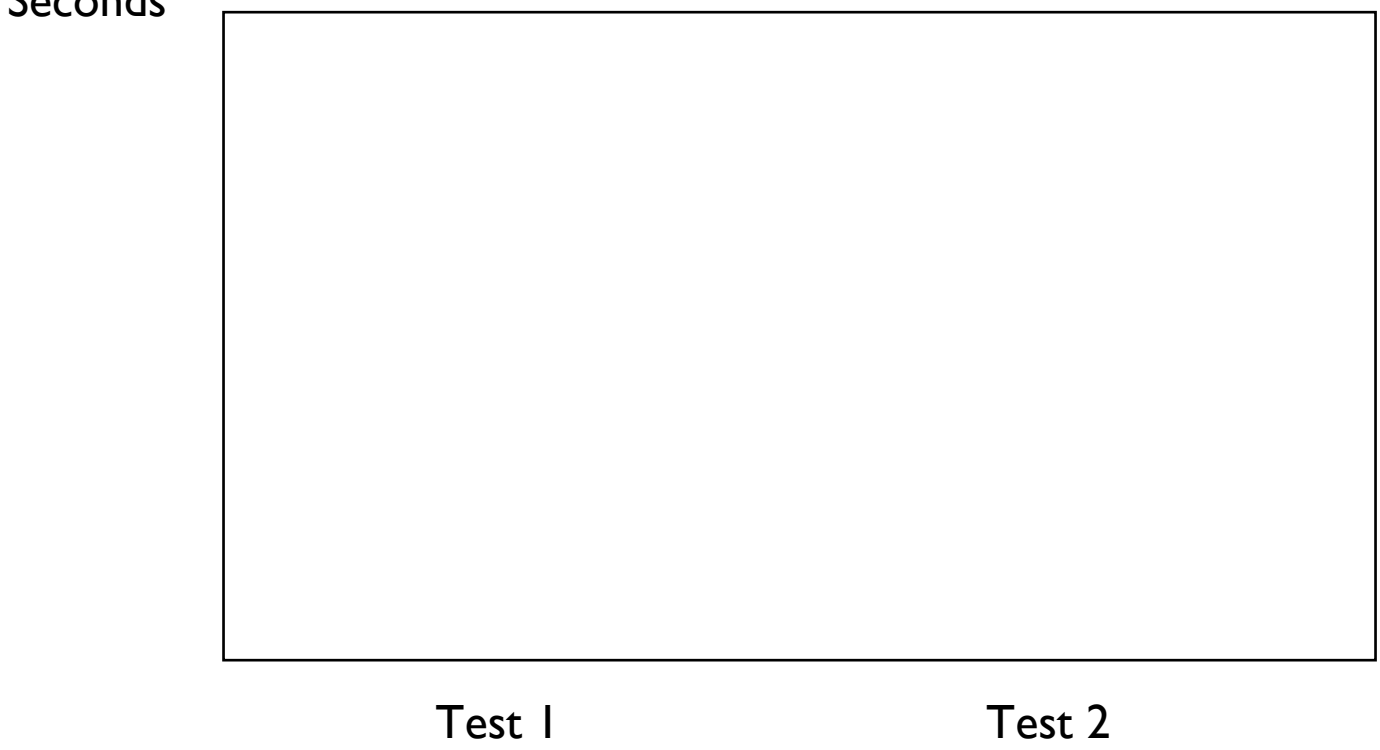
Blade perimeter: _____

Blade area: _____

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

Data Graph

Record the data from the first and second test below.



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 <u>at least</u> ____ 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? _____

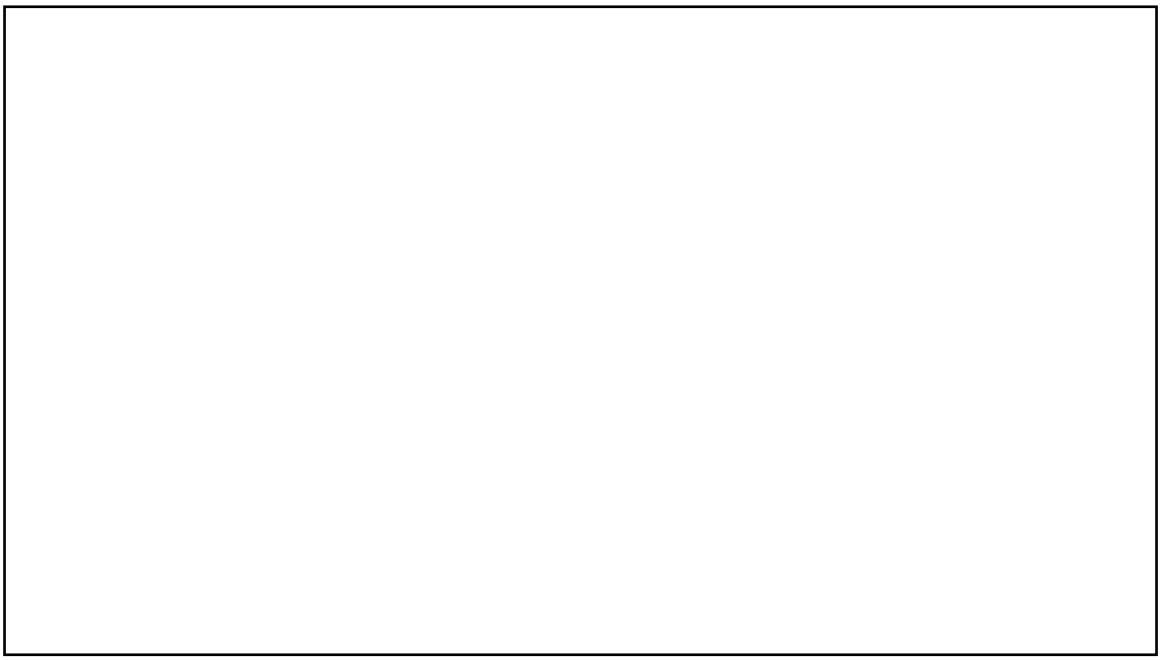
Did your design meet the goal? Why or why not?

_____

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 1

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?