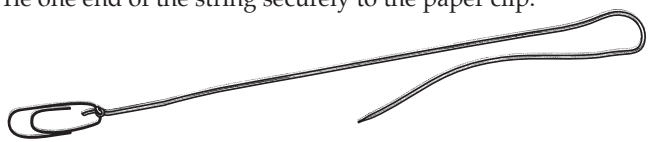
HOW TO BUILD A SWINGER

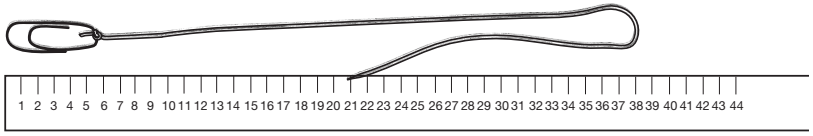
MATERIALS

1	String, about 50 cm long	1	Meter tape
1	Paper clip	1	Penny
•	Masking tape		

1. Tie one end of the string securely to the paper clip.

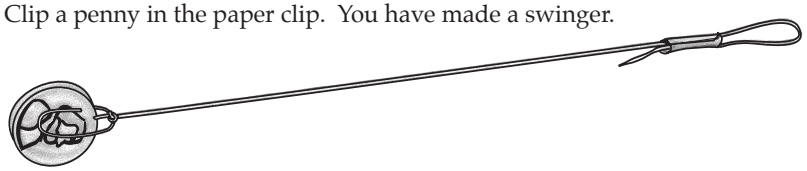


2. Measure exactly 38 cm from the tip of the paper clip along the string. Fold the string back at exactly the 38-cm mark.



3. Put a tiny piece of masking tape around the string to make a loop. The loop should be large enough to hang over a pencil. Remeasure to make sure the swinger is 38 cm from the tip of the paper clip to the top of the loop.

4. Clip a penny in the paper clip. You have made a swinger.



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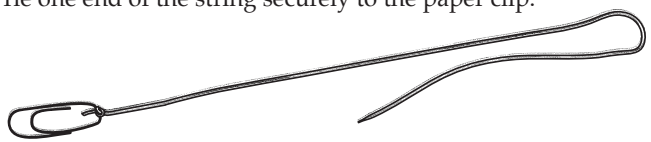

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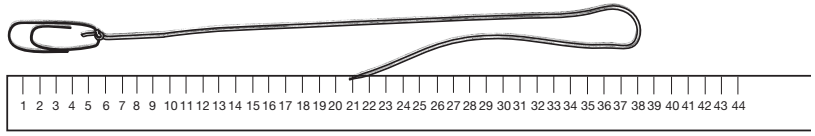

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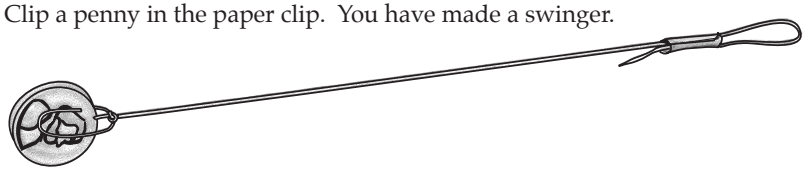

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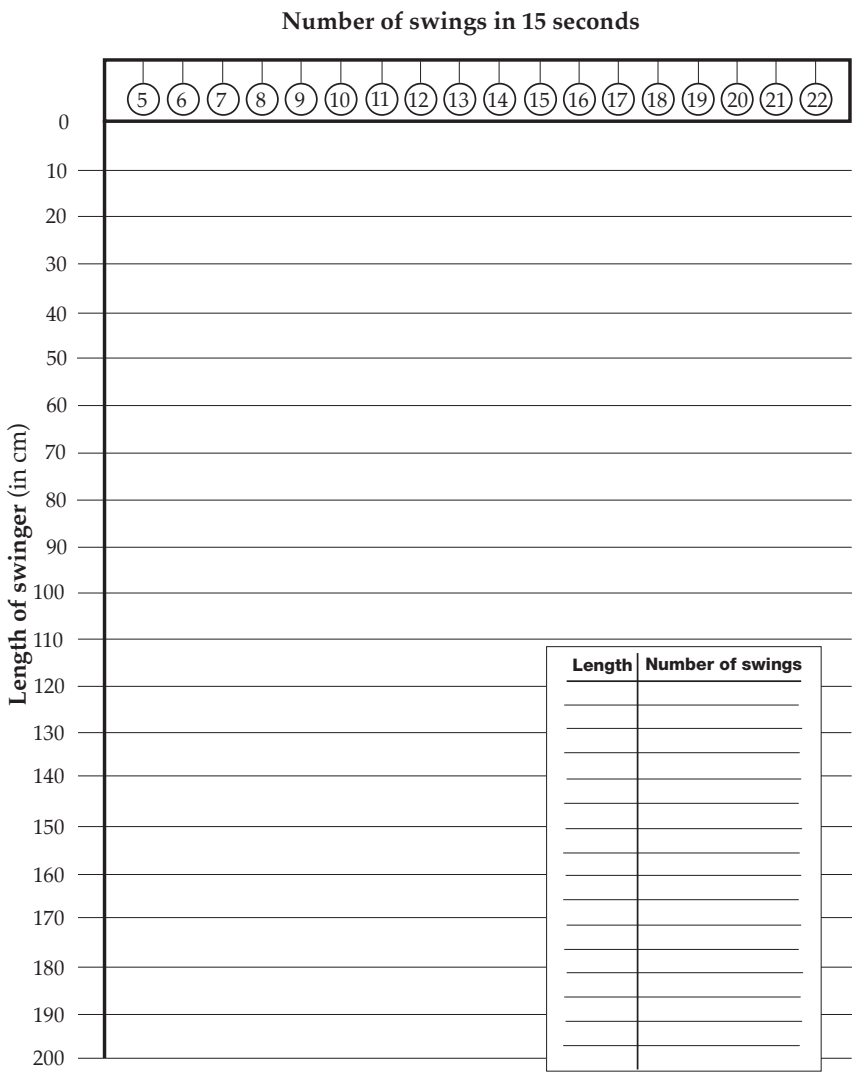
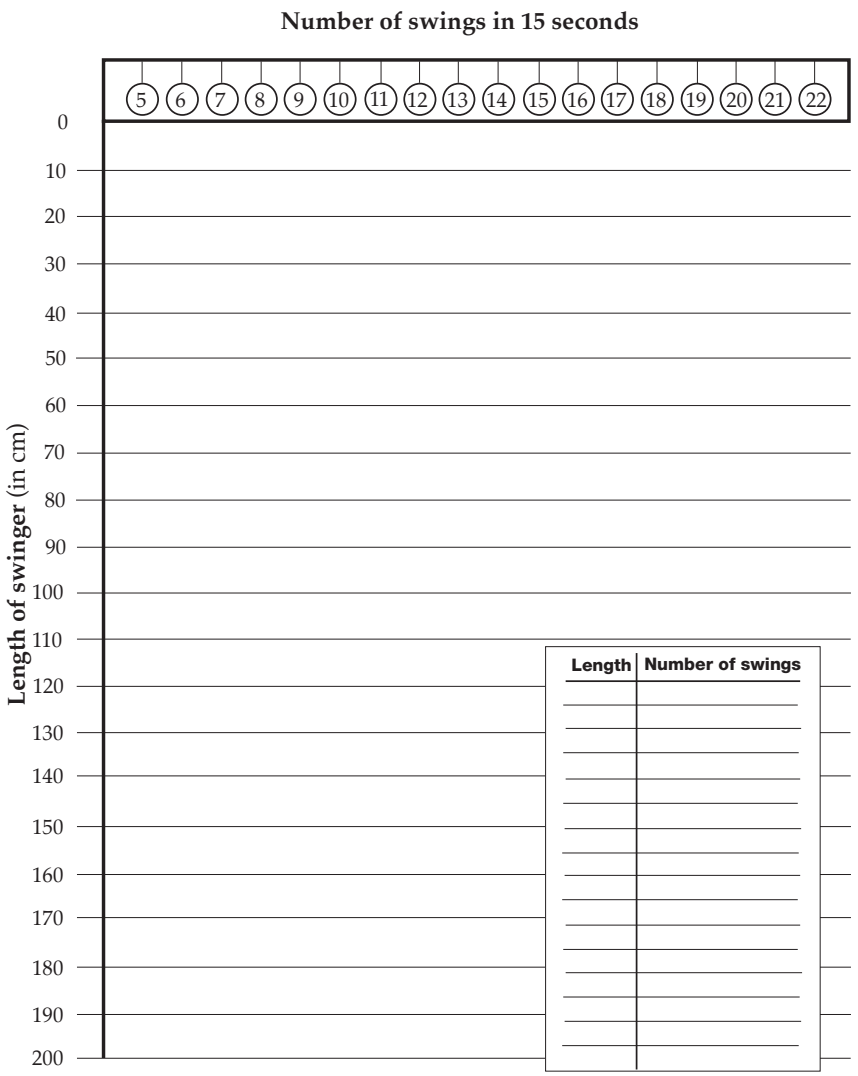
Investigation 1: Swingers
No. 3—Student Sheet

SWINGERS PICTURE GRAPH



SWINGERS PICTURE GRAPH



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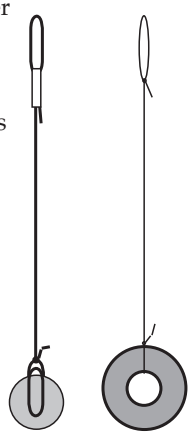
Investigation 1: Swingers
No. 5—Student Sheet

RESPONSE SHEET—SWINGERS

A student wanted to know what would happen in the swinger experiment if he changed the way he made the pendulum. Instead of using string he used fishing line to make his pendulum the standard 38 cm long. He used a washer at the end for the pendulum bob. Then he counted how many times his pendulum swung back and forth in 15 seconds.



Do you think he has done a good job of controlling the variables? Why or why not?

What do you think he will find out when he swings the pendulum for 15 seconds?

RESPONSE SHEET—SWINGERS

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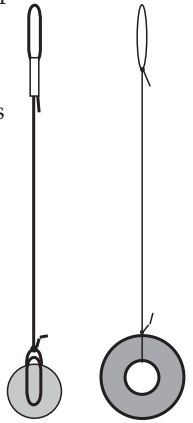

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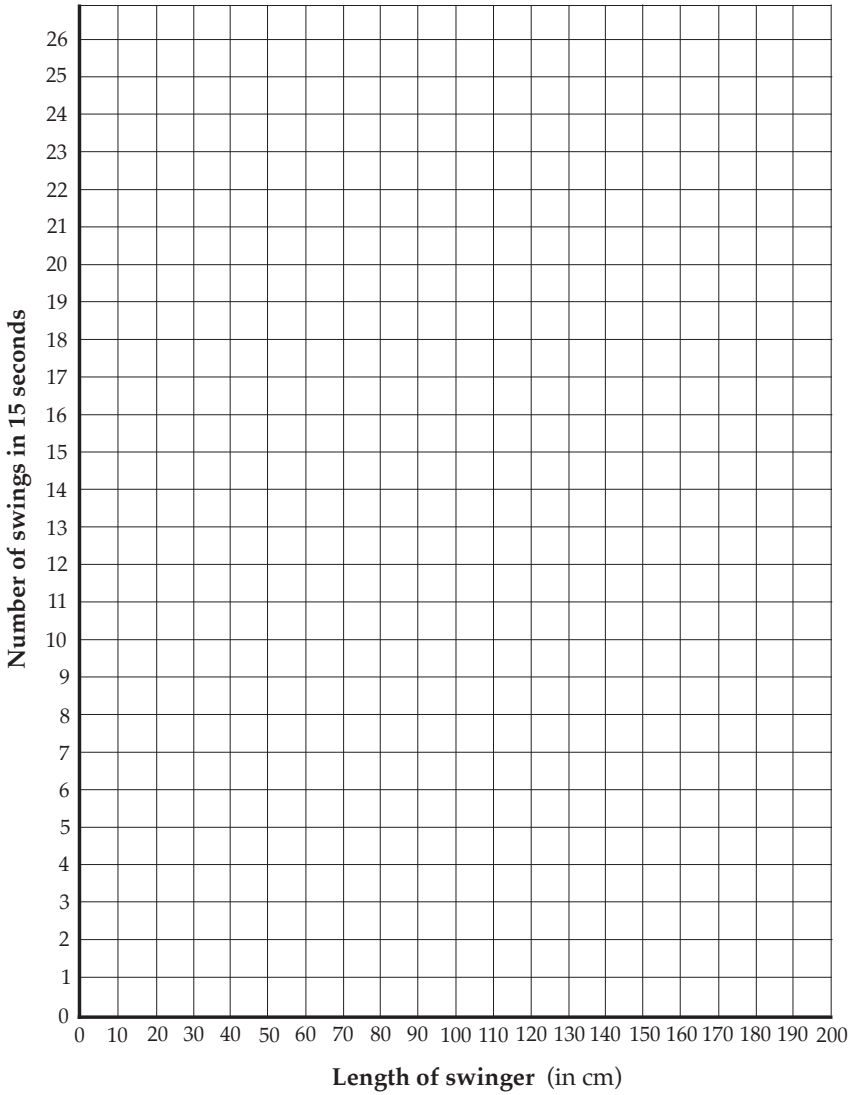
Investigation 1: Swingers
No. 6—Student Sheet

SWINGERS TWO-COORDINATE GRAPH



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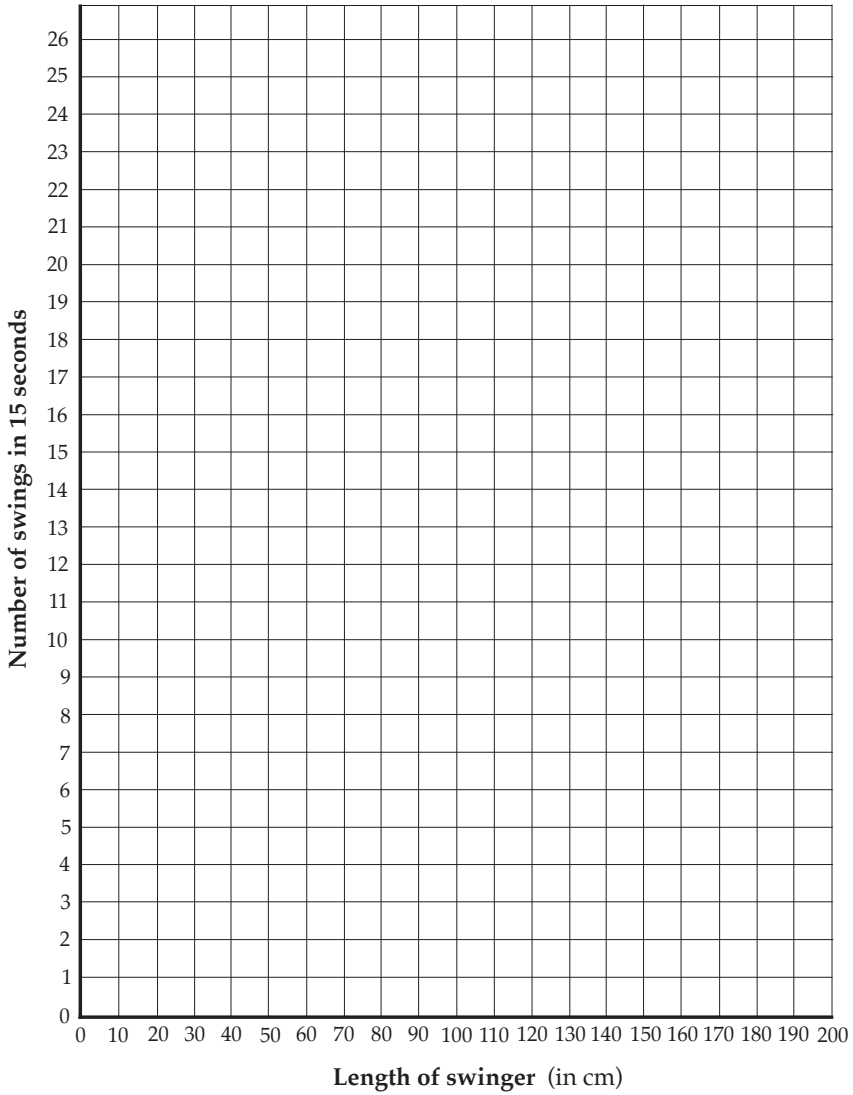

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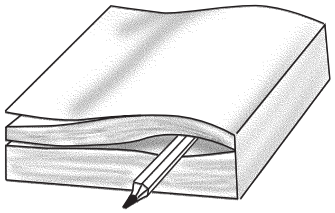
Investigation 1: Swingers
No. 7—Student Sheet

BOAT BUILDING

MATERIALS

1 Cup	1 Book
1 Pencil or pen	1 Meter tape
1 Scissors	

1. Place a pencil in a book so that the point sticks out. The point should be *exactly 3 cm* above the tabletop.



2. Bring a cup up to the point of the pencil. Rotate the cup to draw a line all the way around, 3 cm from the base.

3. Carefully cut the cup on the line.

BOAT BUILDING

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1 Cup	1 Book
1 Pencil or pen	1 Meter tape
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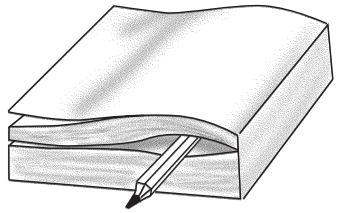

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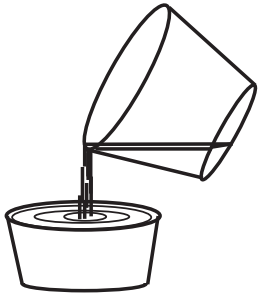
Investigation 2: Lifeboats
No. 8—Student Sheet

MEASURING LIFEBOAT CAPACITY

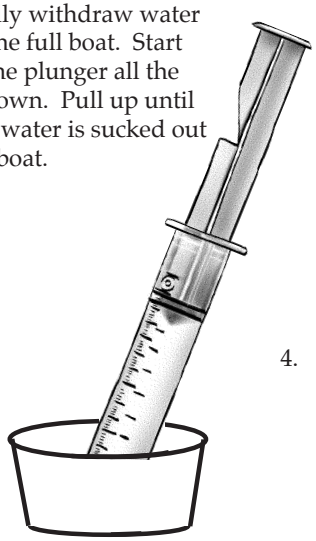
MATERIALS

1	Plastic cup of water
1	Graduated cylinder
1	Syringe, 50-ml

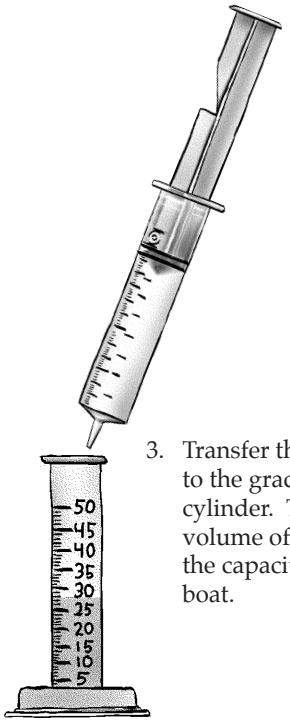
1. Fill the boat to capacity with water.



2. Use the syringe to carefully withdraw water from the full boat. Start with the plunger all the way down. Pull up until all the water is sucked out of the boat.



3. Transfer the water to the graduated cylinder. The volume of water is the capacity of the boat.



4. If the boat is larger than 50 ml, suck up 50 ml of water from the boat and return it to the water supply. Then suck up the rest of the water and measure it in the graduated cylinder. The capacity of your boat is the volume of water in the cylinder plus 50 ml.

MEASURING LIFEBOAT CAPACITY

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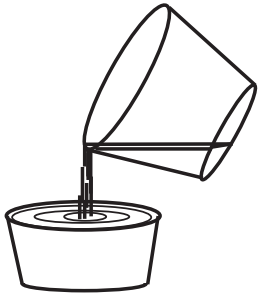

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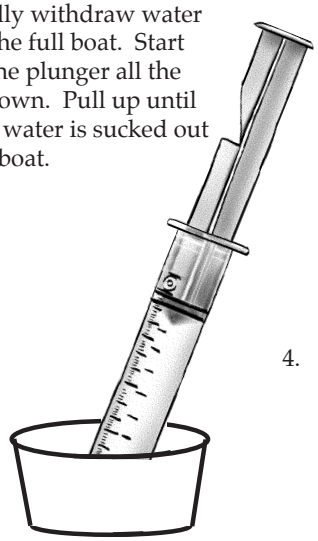

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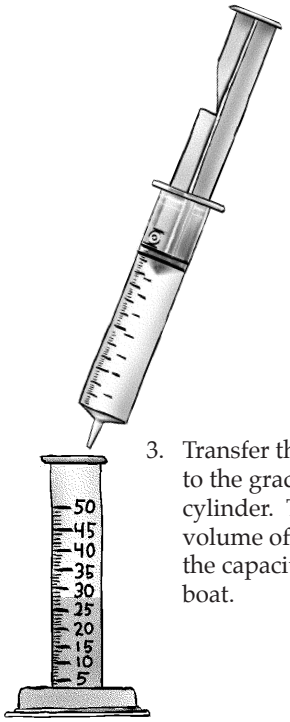

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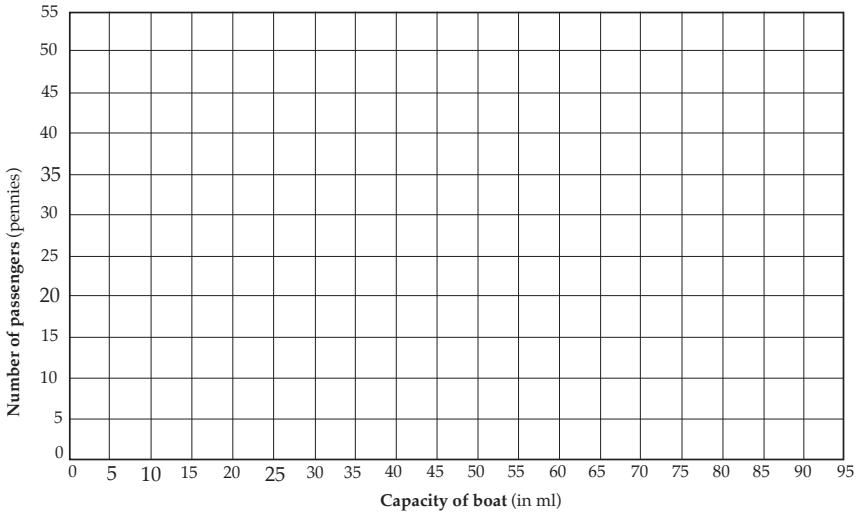
Investigation 2: Lifeboats
No. 9—Student Sheet

LIFEBOAT INSPECTION

PART 1. Fill in the names and capacities of your fleet of boats in the chart below.

Boat	Boat name	Capacity (ml)	Passengers supported
1			
2			
3			
4			

PART 2. Graph the results of your lifeboat investigations.



PART 3. Fill in the names and capacities of the borrowed boats in the chart below.

Boat	Boat name	Capacity (ml)	Passengers supported	
			Predicted	Counted
1				
2				
3				
4				

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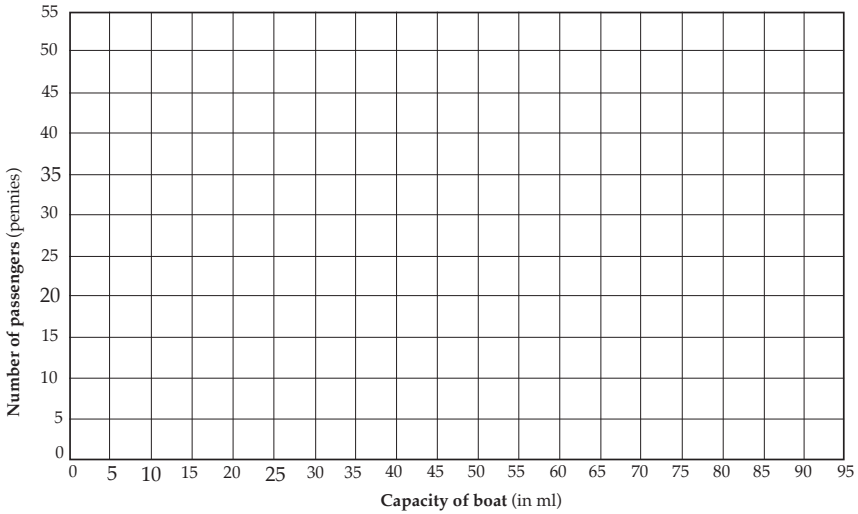

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4				

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Investigation 2: Lifeboats
No. 10—Student Sheet

RESPONSE SHEET—LIFEBOATS

Billy forgot to eat his ice cream while he was watching television, and it melted. He thought the ice cream melted because it was in the light. Billy decided to do an experiment to find out. Here's what he did.

As soon as it got dark, Billy put one scoop of chocolate chip ice cream into two identical bowls. He put one bowl outside where it was dark and put the other in the kitchen where a light would shine all night. Billy got up at dawn and discovered that the ice cream outside was still solid but the ice cream in the kitchen had melted.

"Aha," said Billy, "light makes ice cream melt!"

Do you think Billy's experiment was good? Explain why or why not.

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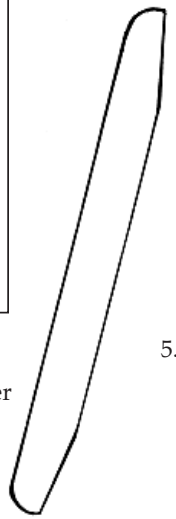
Investigation 2: Lifeboats
No. 11—Student Sheet

FOSS PLANE CONSTRUCTION

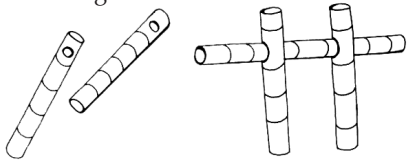
MATERIALS

- 1 Propeller
- 1 Hook
- 1 Jumbo straw
- 1 Super jumbo straw
- 1 Rubber band, #33
- 2 Craft sticks
- 1 Hole punch
- 1 Scissors
- 1 Stapler
- 1 Sandpaper piece

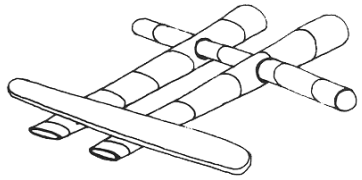


1. Use sandpaper to taper *both ends* of both craft sticks on *one side*.

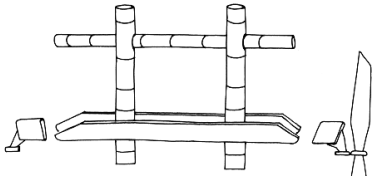
2. Cut the *super jumbo* straw in half. Punch one hole in each half near the end. Slide the *jumbo* straw through the holes.



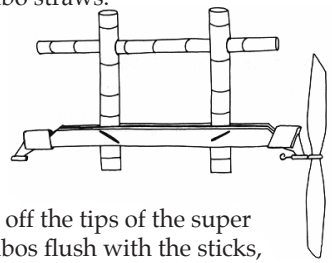
3. Flatten the free ends of both super jumbo straws. Use a craft stick.



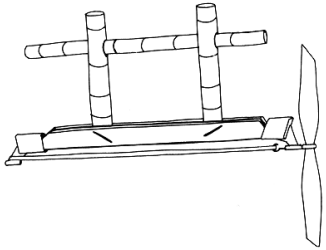
4. Trap the flattened ends of the two super jumbos between the two tapered craft sticks. Make sure the tapered edge is up. Slide the propeller on one end and the hook on the other.



5. Adjust the position of the super jumbos, making sure that they are long enough to allow the propeller to turn without hitting the jumbo-straw crosspiece. Staple through the sticks and the super jumbo straws.



6. Cut off the tips of the super jumbos flush with the sticks, and cut the jumbo crosspiece to a convenient length. Attach the rubber band between the prop and hook, and FLY!



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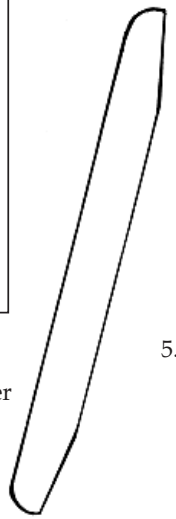

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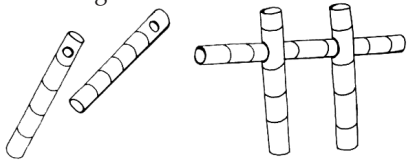

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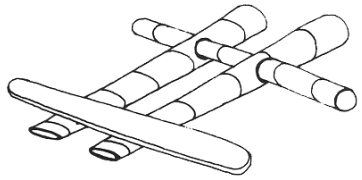

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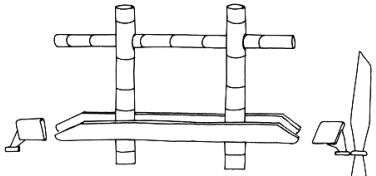

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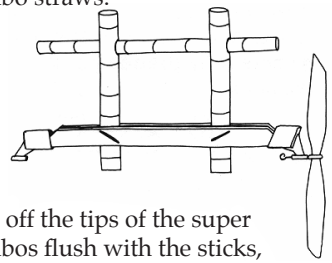

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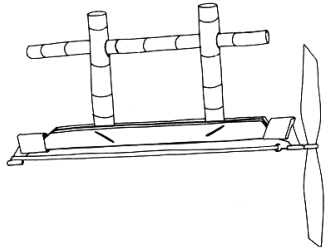

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Investigation 3: Plane Sense
No. 12—Student Sheet

FLIGHT LOG

PART 1

Our FOSS plane is called _____

Our flight line is _____ centimeters long.

Our plane needs _____ winds of the propeller to fly the length of the line.

PART 2

We guess that our plane will need _____ winds to fly halfway down the line.

We discovered that our plane needs _____ winds to fly halfway down the line.

If your guess was different from your measured result, explain why.

PART 3

Additional variables that we think might affect the flight of our FOSS plane.

_____ _____

_____ _____

_____ _____

PART 4. Your next task is to select one variable and test it to see how it affects the performance of your plane.

The variable we will investigate is _____

The standard number of winds we will use is _____

The outcome we will measure is _____

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Our plane needs _____ winds of the propeller to fly the length of the line.

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The outcome we will measure is _____

FOSS Variables Module
Investigation 3: Plane Sense
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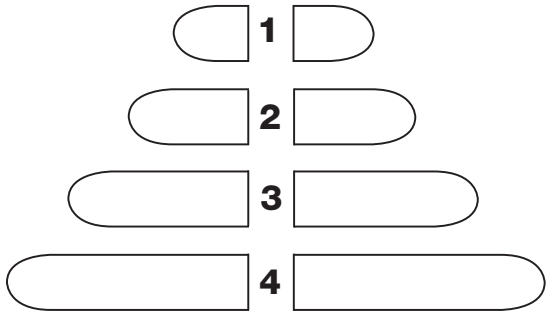
No. 13—Student Sheet

RESPONSE SHEET—PLANE SENSE

A student wanted to test her FOSS plane to find out if wings would help her plane fly the length of the flight line any faster. She constructed four sets of wings. Each had the same shape, the same width, and a different length.

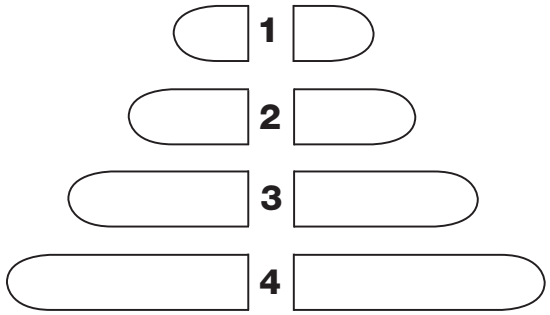


She started by setting up a flight line and putting 60 winds on the propeller of her plane. She got a stopwatch and timed how long it took the plane to fly from one end of the flight line to the other without any wings.

What should she do next to complete her experiment and report her findings to her class?

RESPONSE SHEET—PLANE SENSE

A student wanted to test her FOSS plane to find out if wings would help her plane fly the length of the flight line any faster. She constructed four sets of wings. Each had the same shape, the same width, and a different length.



She started by setting up a flight line and putting 60 winds on the propeller of her plane. She got a stopwatch and timed how long it took the plane to fly from one end of the flight line to the other without any wings.

What should she do next to complete her experiment and report her findings to her class?

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Investigation 3: Plane Sense
No. 14—Student Sheet

DESIGN AN EXPERIMENT: PLANE SENSE

Describe your standard plane system.

Slope of the flight line _____

Power supply (rubber bands)

Number of winds on the power supply _____

Number of passengers (paper clips) _____

Our standard plane flies _____ centimeters along the flight line.

Our experimental variable is _____

The increment we will use to change the experimental variable is _____

NOTE: Incremental changes are changes that are all the same size. For example, an incremental change for the experimental variable of passengers could be to add 1 passenger for each test: 0 passengers, 1 passenger, 2 passengers, 3 passengers, and so forth. Or the incremental change could be 2 passengers: 0 passengers, 2 passengers, 4 passengers, and so forth.

Experimental test	Experimental variable (list increments)	Outcome (distance)
Test 1 (standard)		
Test 2		
Test 3		
Test 4		

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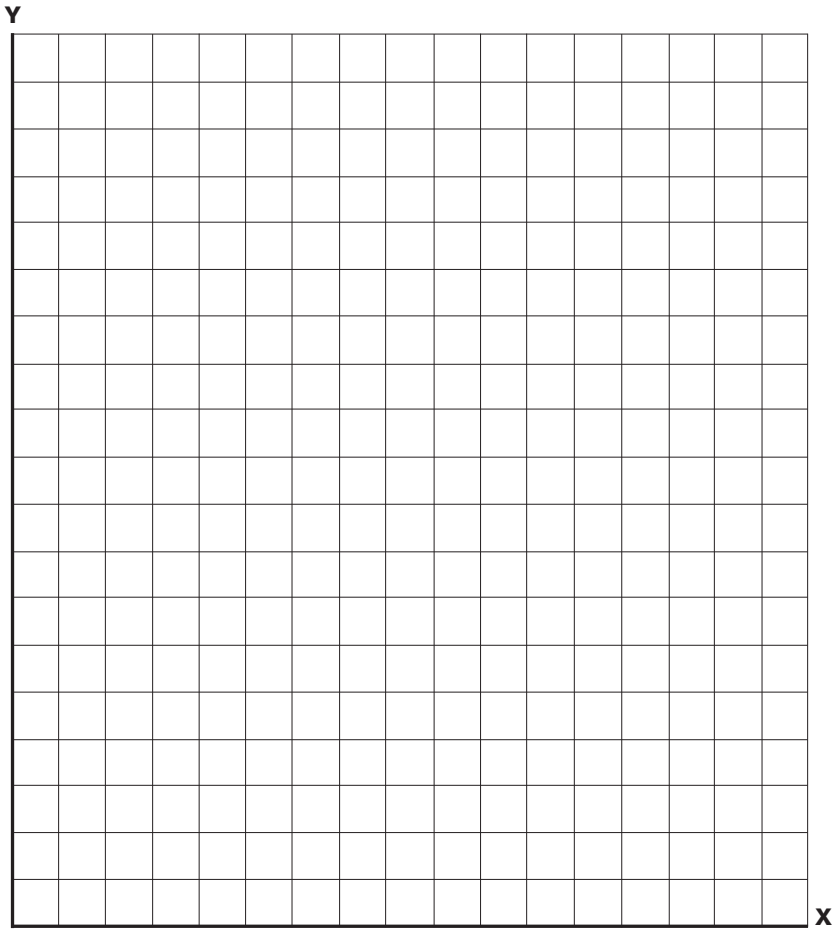
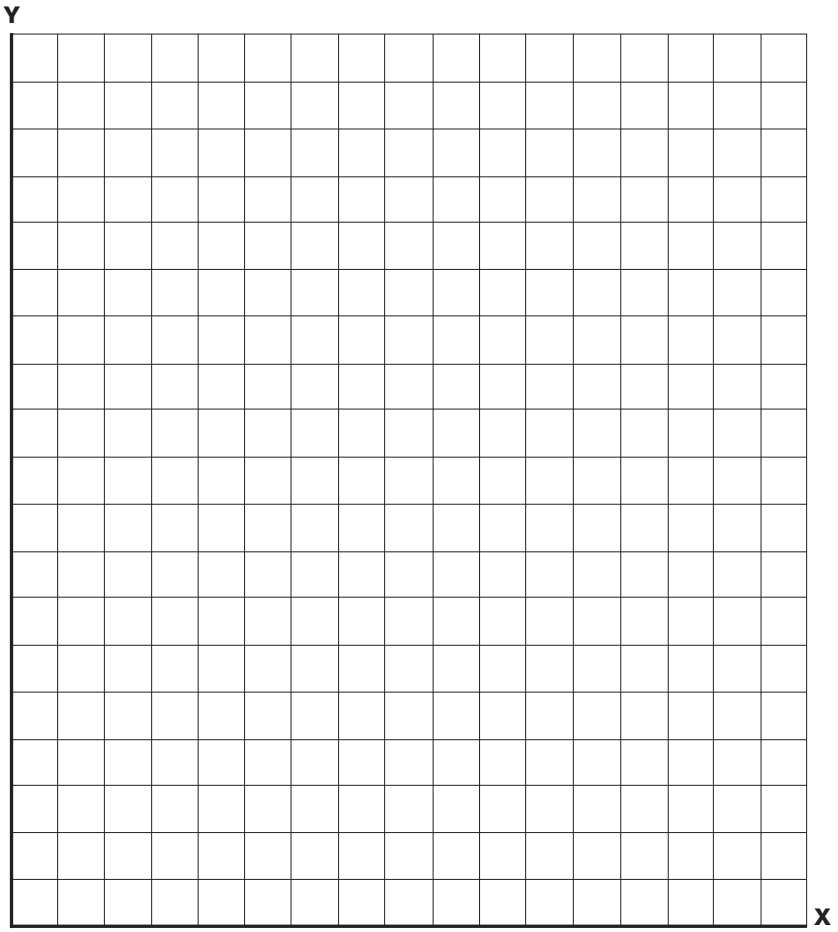
Investigation 3: Plane Sense
No. 15—Student Sheet

TWO-COORDINATE GRAPH



TWO-COORDINATE GRAPH



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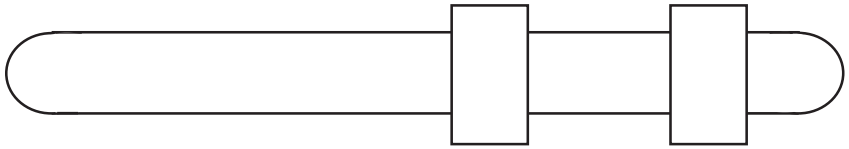
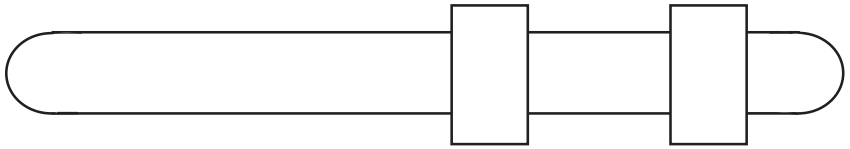
Investigation 3: Plane Sense
No. 16—Student Sheet

FLIP-STICK CONSTRUCTION



MATERIALS	ASSEMBLY PROCEDURE
1 Craft stick 2 Short pieces of stick • White glue	1. Lay a craft stick on the diagram above. 2. Glue two short wooden crosspieces to the craft stick in the locations indicated. 3. Use only enough glue to do the job. 4. Let the stick dry overnight.

FLIP-STICK CONSTRUCTION



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Investigation 4: Flippers
No. 17—Student Sheet

FLIPPING ALUMINUM BALLS

PART 1. How high can you flip?

Describe the flipper system that resulted in the highest flip.

Discuss all of the variables.

PART 2. How far can you flip?

Record the following information in your journal:

- Describe the flipper system that resulted in the longest flip.
- List your variables and how you plan to control them.
- Set some standards (where you will measure from, etc.)
- How will you collect and record your data?

Describe the system that resulted in the longest flip.

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Investigation 4: Flippers
No. 18—Student Sheet

RESPONSE SHEET—FLIPPERS

A student was interested in studying how a lifeboat's shape affects its ability to carry passengers.

Boat	Size of aluminum foil before shaping into a boat	Shape of boat	Passengers needed to sink the boat
1	10 cm x 30 cm	rectangular	23 passengers
2	10 cm x 30 cm	oval	24 passengers
3	20 cm x 30 cm	square	32 passengers
4	20 cm x 30 cm	triangular	31 passengers

Do you think she designed a controlled experiment? Why or why not?

What would you do the same and what would you do differently?

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Investigation 4: Flippers
No. 19—Student Sheet

DESIGN AN EXPERIMENT: FLIPPERS

PART 1. Describe the standard launch setup.

What is the angle of launch? _____

What is being launched? _____

Where is the object placed? _____

How far out is the flip stick? _____

How far is the flip stick pressed down? _____

PART 2. Draw a picture of your standard launch setup.

PART 3. Set up your flipper experiment.

Our experimental variable is _____

We expect to find out _____

How the variable will change	Trial number				Result
	1	2	3	4	

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Investigation 4: Flippers
No. 20—Student Sheet

FOSS VARIABLES MODULE

PROJECT PROPOSAL

1. What is the question or the project that you are proposing?

2. What materials or references will you need to complete the project?

3. What steps do you need to take to complete the project?

FOSS VARIABLES MODULE

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Investigation 4: Flippers
No. 22—Student Sheet