



IMPORTANT:
Read all instructions before
proceeding

CONTROLLING VARIABLES WITH PARACHUTING

OVERVIEW: This presentation consists of an introduction to a simple scenario to get students thinking of different variables in an experiment. Students will construct a parachute, identify the variables in the experiment, control the variables, and record their findings.

OBJECTIVE: Students will:

- *Measure the length of the string using metric measurement (cm)
- *Measure the height of the release point using metric measurement (m)
- *Weight the parachute using a gram scale (g)
- *Construct a parachute following directions accurately
- *Predict the effect weight and height of release will have on the time the parachute lands
- *Record the data on a data chart and then interpret the data measured
- *Define the terms variable and margin of error
- *Describe the importance of controlling the variables in an experiment

GRADE LEVEL: 5

OHIO STANDARDS:

Grade 5 Physical Science: The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.

TIME: 45 minutes

MATERIALS: (per group of 2 students)

- *Marker or chalk
- *White board or chart paper
- *Gram scale or balance that measures in grams.

FOR EACH PARACHUTE:

- *One paper diner-sized napkin
- *String (160 cm. long)
- *Ruler w/ cm. side
- *Scissors
- *Five small stickers or tape
- *Four large paper clips

FOR EACH GROUP:

- *One meter stick
- *Masking tape
- *Stop Watch
- *Pencil/pen

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PROCEDURE:

1. Ask students: What are some important things that we have to think about when we do scientific experiments?

Lead students to the scientific method: Predict, hypothesize, observe, measure, record data, and infer.

Ask students: Is there anything else that we might need to do?

Lead students to controlling the variables.

Ask students: If you were going to bake a cake what are some of the variables that might cause the cake to taste different.

List all ideas on the board.

Possible answers: amount of sugar, amount of eggs, amount of flour, amount of salt, amount of oil, how long you baked it, the temperature you baked it at etc.

Define Variable:

A variable is something that can make a difference between items. Like how one thing effects another.

Say: When you do an experiment you try to keep everything exactly the same each time you do the experiment except one item- that is the item you are testing.

Ask: What are some variables that we would need to consider when we do this experiment? *Write all answers on the board.*

2. Say: Now we are going to do a little experiment.

1 Ask for five volunteers.

1 Hand them each a stopwatch.

1 Hold the parachute up about two meters high and say: On the count of three I am going to let the parachute go and each of you are going to time it on its way down.

1 On the board make a chart and write the students name and their time in the chart. The times should all be different.

Ask: Why are all the times different? Different people timed it.

Lead them to: human error: another variable that needs to be controlled.

Ask: How do you think we will be able to control human error. Take suggestions.

1 Introduce the idea that in the Labs at Premcor and at BP they have to control the variables in their experiments everyday. They way they control human error or in their case instrumentation error is that they do a tri-test. They run the machine through a test at least three times with a know substance and then compare the results.

3. Say: There is one more thing you need to know before we start putting together the parachutes.

Say: There are two forces that act on a parachute.

Ask: Does anyone know what these forces are?

Take out two napkins. Crumble one up and leave the other one just flat(regular).

Say: If I drop these at the same time which one is going to land first.

Take suggestions.

Drop them.

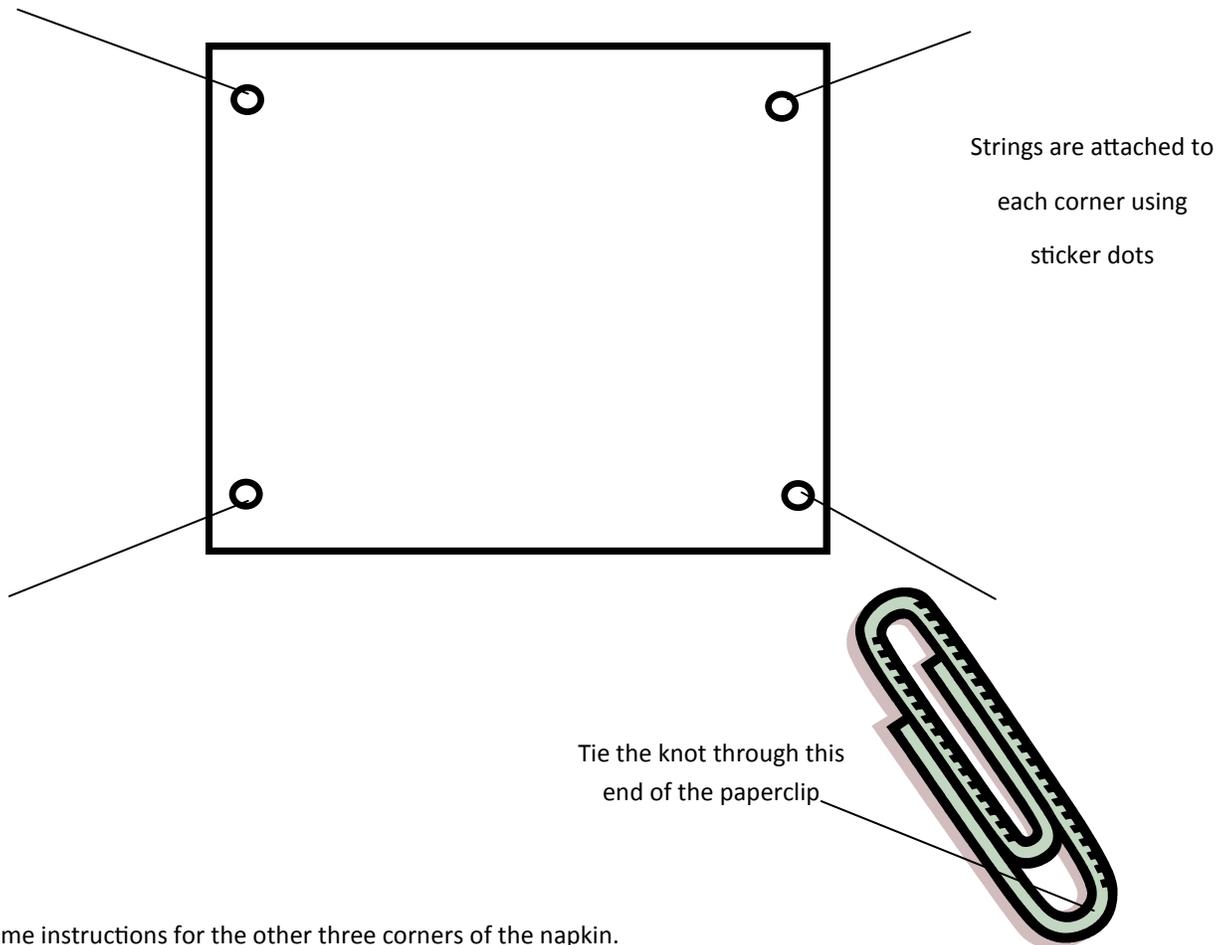
Ask: Why did the crumbled up one fall faster; they both have the exact same mass?

Lead students to: surface area. The Force that acts upon surface area is called Lift.

Ask: What is the other force acting on the napkin? Gravity

4. Activity:

1. Open the napkin completely and place on the table.
2. Measure and cut string into four 40 cm lengths.
3. Lay one string at a diagonal on each corner of the napkin and seal in place with a sticker or piece of tape. (see diagram)



4. Follow these same instructions for the other three corners of the napkin.
5. Gather up the ends of the strings carefully and lift the napkin into the air by the strings just above the table.
6. Make sure the strings are equal in length and thread strings through the large end of the paper clip. Then tie a knot.
7. Refer to the record sheet for further instruction

Controlling Variables

Part I:

Essential Question:

How is the weight added to the parachute going to effect the time it takes the parachute to land?

Prediction:

Hypothesis:

If ...

Then...

Procedure:

1. Measure 1m, 1.5m, and 2m on a wall mark each spot with tape. Make sure you label each piece.
2. Your first chart you will be manipulating the weight of the parachute. Before each trial you will need to weigh your parachute on a balance in grams.
3. First trial, weigh the parachute by itself.
4. You will be releasing the parachute from 2m high.
5. Timer will count down the release and start the stopwatch upon release.
6. Record the time in the proper box on the chart.
7. Next, add a paper clip to the parachute. Weigh it and then repeat the release procedure.
8. Repeat the procedure by adding a second paper clip and then a third.

PARACHUTE RELEASE COMPARING WEIGHT

Number of Paper Clips	Weight (g)	Time (sec.)
1		
2		
3		
4		

State your observations: (What happened)

Make an inference explaining your observations.

Questions:

How does the amount of weight added to the parachute each time effect the time it takes for it to land?

Why did you have to weigh the parachute each time?

Did you have to retest at all? If so why?

What two forces were acting on the parachute?

Part II

Directions: Now you will change jobs. Since there is a new timer you need to determine their margin of error.

Jobs:

Timer/Recorder:

Paratrooper:

Essential Question:

How does the height that the parachute is released at effect the amount of time it takes to land?

Prediction:

Hypothesis:

If ...

Then...

Procedure:

1. This time you are going to be manipulating the height at which you release the parachute.
2. Weigh your parachute on the balance in grams.
3. Record the weight on the chart.
4. Your first release will be from 2m high.
5. Timer will count down the release and start the stopwatch upon release.
6. Record the time in the proper box on the chart.
7. Next, weigh the parachute again and repeat the release procedure from 1.5 m.
8. Last weigh the parachute again and repeat the release procedure from 1m high.

PARACHUTE RELEASE COMPARING HEIGHT

TRIAL #	WEIGHT (g)	HEIGHT (m)	Time (sec.)

State your observations: (What happened)

Make an inference explaining your observations.

Questions:

How does the height, which the parachute was released at each time effect the time it takes for it to land?

6. Why did you have to weigh the parachute each time?

Did you have to retest at all? If so why?

What two forces were acting on the parachute?

List the variables that you needed to control for this experiment.

Wrap-Up

After students have finished with the experiment discuss what some of the variables where that needed to be controlled. Write them on the board or on chart paper. Also, discuss the forces that acted on the parachute. (Drag and gravity)

Extensions:

1. Students can work on ratios. Figuring weight per sec and height per sec.
2. Graph the data charts on graph paper or using an excel program.
3. Discuss the history of the parachute and show the video [As It Happened: Berlin Airlift: The First Battle of the Cold.](#) Talk about Uncle Wiggly Wings.
4. Change the material used for the parachute: Compare fabric, plastic and paper parachutes.

Resources:

[As It Happened:Berlin Airlift: The First Battle of the Cold.](#), History Channel