

Mass Data Protocols

Safety Protocols

When working with the lab materials, the following safety precautions are necessary.

- Only conduct the activity under the supervision of qualified personnel who can respond quickly to any unforeseen circumstances.
- Students involved in setting up the equipment and conducting the experiment must be properly trained in handling the sensor carts and understand the experimental procedures.
- Wear appropriate personal protective equipment (PPE) including sanitized safety glasses with side shields during the setup, experimentation, and takedown segments of the activities.
- Secure loose clothing, wear closed-toe shoes, and tie back long hair.
- Use caution when using sharps (tools, etc.), which can cut or puncture skin.
- Clear the workspace of any obstacles or hazards that could interfere with the experiment or cause accidents during the collision.
- Make sure that all parts of the carts are properly secured and stabilized before conducting the collision test. Follow manufacturer guidelines for setup and operation.
- Immediately clean up anything that falls on the floor, so it does not become a slip or fall hazard.
- Maintain a safe distance from the collision area during the activity to avoid injury from flying debris or malfunctioning equipment.
- Following the activity, inspect all equipment for any damage or wear and tear. Report any damage to the instructor so any damaged components can be repaired or replaced before further use.
- Wash hands with soap and water once all equipment is put in appropriate storage areas.

Materials

- sanitized safety glasses with side shields
- variable mass cart (with preset braking washers)
- gravel/sand
- digital scale (3 kg max)
- 24-oz deli container
- ramp setup with brake release block
- stopwatch
- computer with access to <https://codap.concord.org/app/static/dg/en/cert/index.html>

Mass Adjustment and Measurement Protocol

Changing mass

Add or remove gravel/sand until the cart is the mass you want to test.

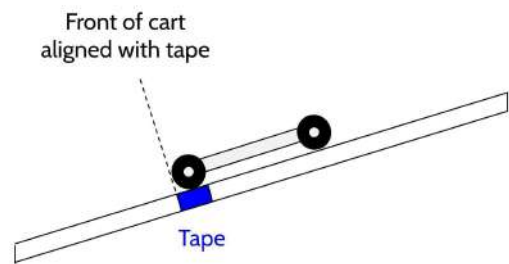
Measuring mass

Place the 24-oz deli container on the digital scale and tear the scale so it reads zero. Then gently place the cart on the container as shown. Change the mass to the desired value and record it on your *Braking Investigation* handout.



Cart Release Protocol

1: Position the cart on the ramp, making sure the front of the cart is aligned with the tape on the ramp that shows the starting point.



2: Place the brake trigger under the brake and place the slack of the string on the ramp behind the cart.

Note: The brake trigger should release the brake when the cart reaches the bottom of the ramp. If the string gets caught on anything (such as the ramp) when the cart is released, the brake will engage early and the timing data will be off. If you notice that the string got caught, redo that trial.



3: Once the person who is timing is ready, release the cart. Watch to make sure the brake releases correctly when the cart reaches the bottom of the ramp.

Time Measurement Protocol

Hand timing: The person timing needs to let the person releasing the cart know when they are ready to time. Then have the other person release the cart. At the moment when the cart reaches the bottom of the ramp and the brake engages, start the stopwatch. Stop the stopwatch as soon as the cart comes to a full stop. To enhance accuracy, consider conducting multiple trials for each condition. Record the times on your *Braking Investigation* handout.

CODAP Graphing Protocol

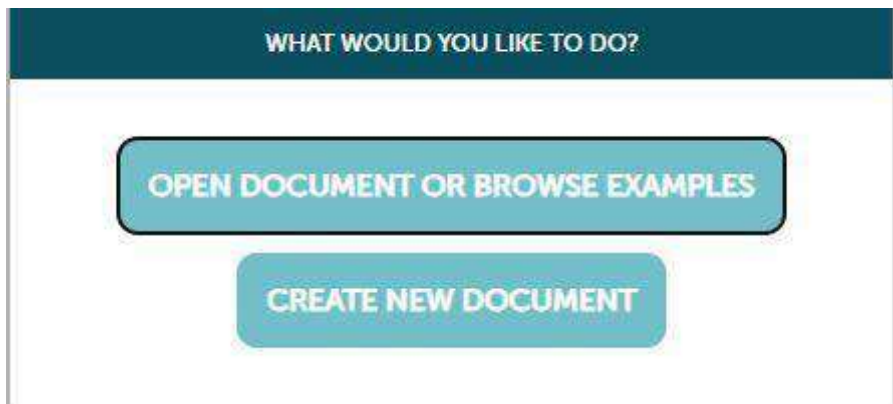
1: Open CODAP

Open your web browser and type in the CODAP website's address:

<https://codap.concord.org/app/static/dg/en/cert/index.html>

2: Create a new data document

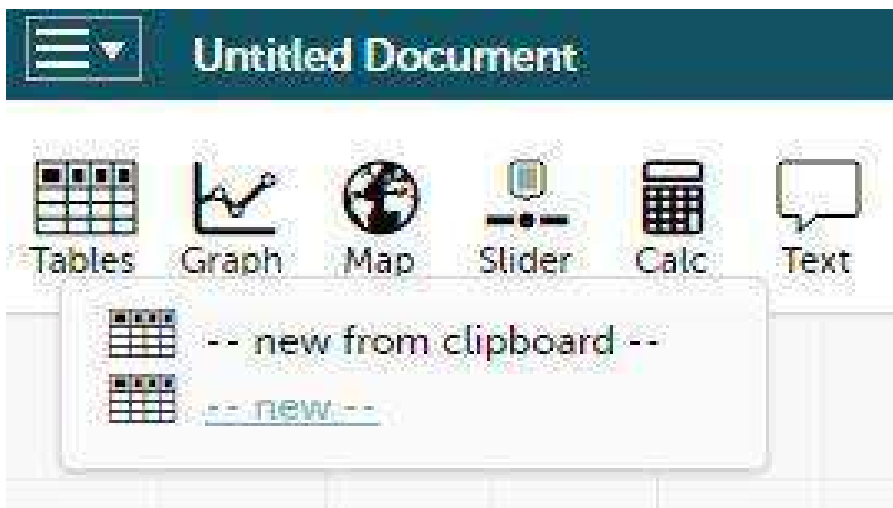
Click on the "Create New Document" button.



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

3: Create a table

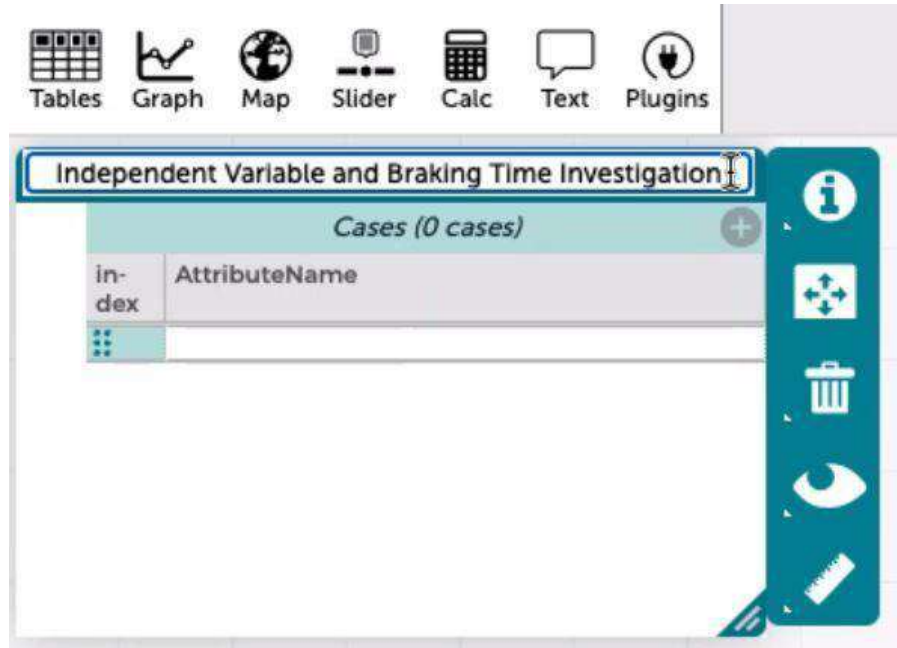
Click on the "Tables" icon in the upper left menu, then click on "--new--".



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

4: Name the table

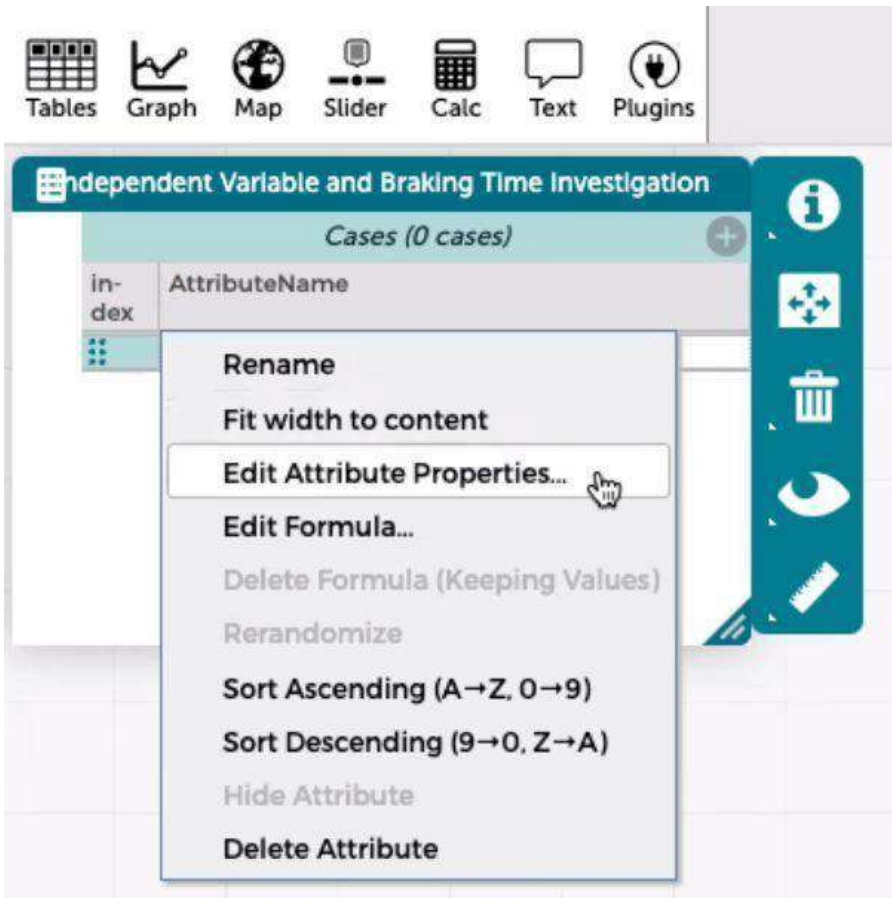
Type in a title that describes the independent and dependent variables you are investigating; for example, “_____ [your independent variable] and Braking Time Investigation”. Then press the “Enter” key. You can edit the title as needed by clicking on it.



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

5: Name the independent variable column

Click on the column's heading "AttributeName". Then select "Edit Attribute Properties" in the menu. Type in an entry that represents your independent variable for "name" in the popup, and type in the appropriate "unit" below. Then click on "Apply".



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

Attribute Properties

name **Independent Variable**

description Describe the attribute

type

unit **example: kg**

precision 2

editable True False

Cancel Apply

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6: Add and name a dependent variable column
 Click on the gray plus sign ⊕ in the upper right part of the table. As in **step 5**, type in a name for the dependent variable and the unit, then click on “Apply”.

Tables Graph Map Slider Calc Text Plugins

Independent Variable and Braking Time Investigation

Cases (0 cases)

in- dex	Independent Variable (example: kg)

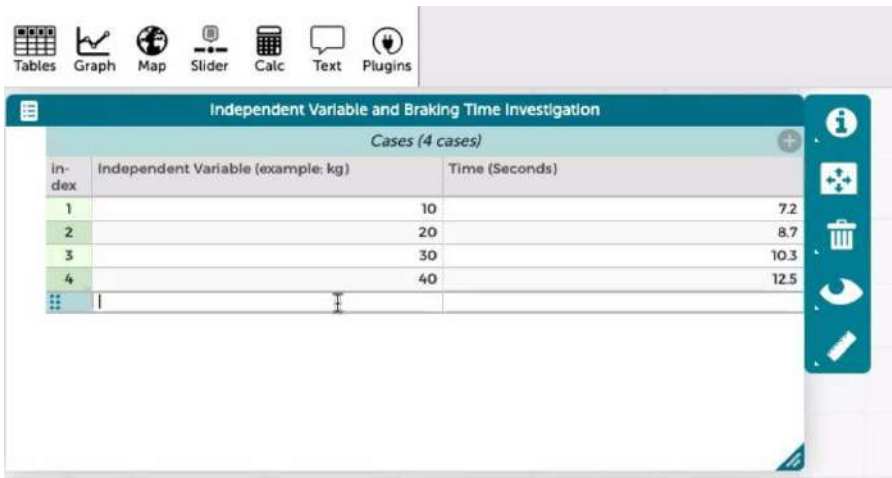
Add a new attribute to this table

Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

7: Input your data

To add data to your table, double-click on the appropriate cell and type in the value you recorded. Then press the “Enter” key.

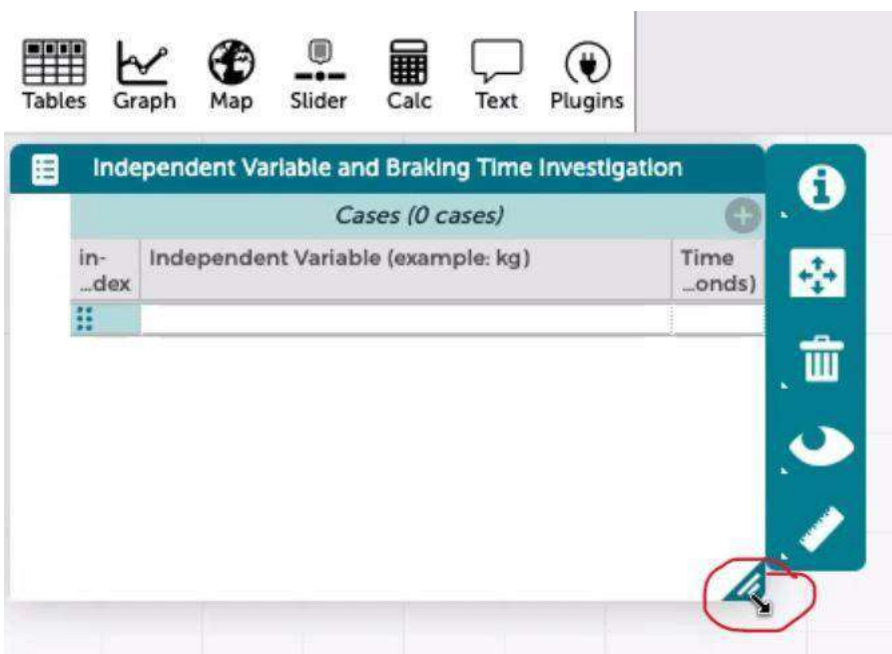
You can resize the table by clicking and dragging its bottom right corner.



The screenshot shows the CODAP interface with a table titled "Independent Variable and Braking Time Investigation". The table has 4 cases of data. The columns are "in-dex", "Independent Variable (example: kg)", and "Time (Seconds)". The data is as follows:

in-dex	Independent Variable (example: kg)	Time (Seconds)
1	10	7.2
2	20	8.7
3	30	10.3
4	40	12.5

Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.



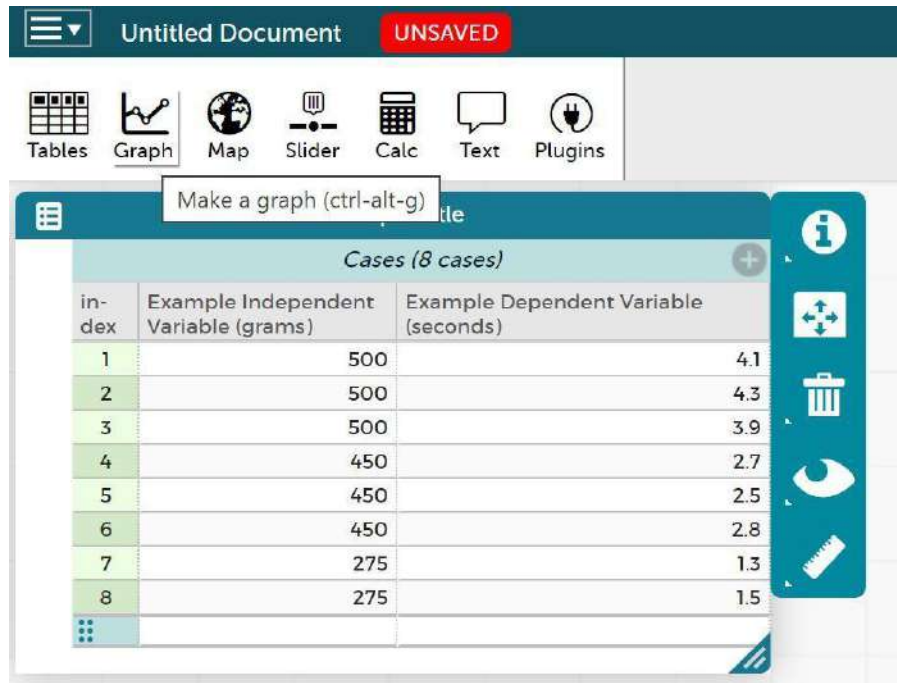
The screenshot shows the CODAP interface with an empty table titled "Independent Variable and Braking Time Investigation". The table has 0 cases of data. The columns are "in-dex", "Independent Variable (example: kg)", and "Time (Seconds)". A red circle highlights the bottom right corner of the table, indicating the area where the user can click and drag to resize the table.

in-dex	Independent Variable (example: kg)	Time (Seconds)
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Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

8: Create a blank graph

Click on the “Graph” icon in the upper left menu. This will open a graph window with random data points.

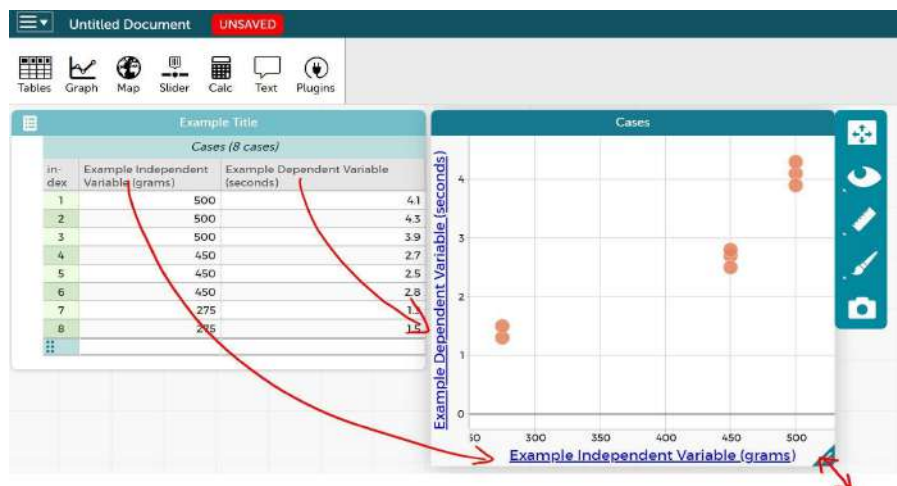


Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

9: Assign variables to the graph axes

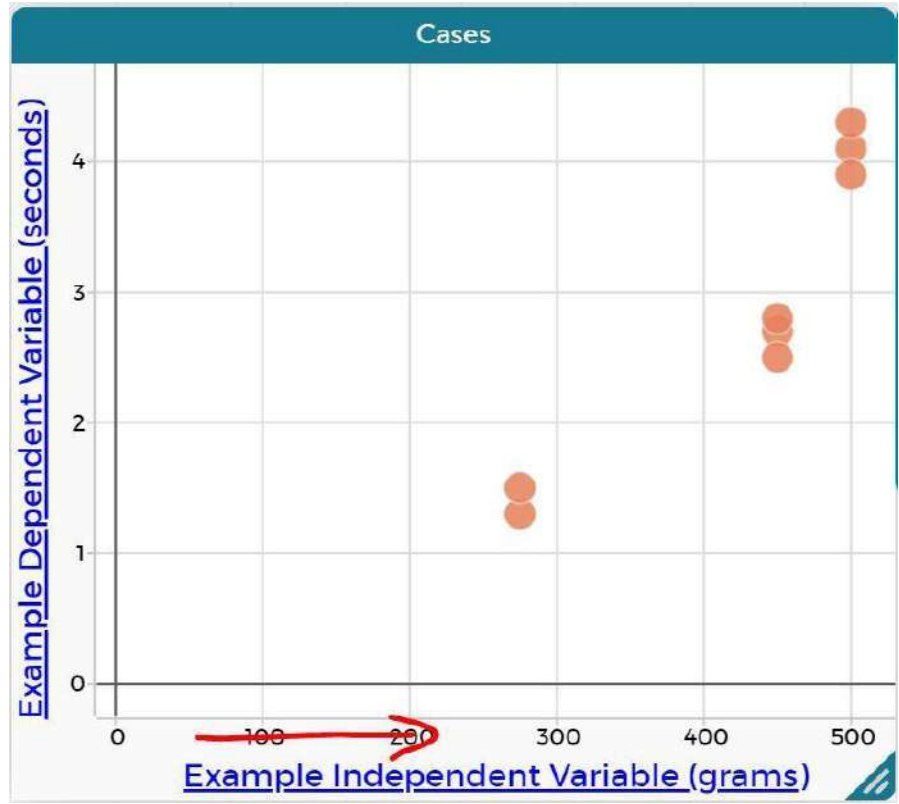
Click and drag the heading of your independent variable column to the x-axis of the graph. Then click and drag the heading of your dependent variable column to the y-axis.

You can resize the graph by clicking and dragging its bottom right corner.



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.

10: Adjust the scales of the graph axes
Click and drag the axes of the graph to adjust the scales to show zero on both.



Images generated using CODAP (<https://codap.concord.org/>), developed at the Concord Consortium.