

Eighth Grade Science Mouse-Trap Car Project

General Information

The Purpose and Goals for this Project:

1. The design of your team's mouse-trap car will demonstrate that you understand forces, motion, and energy scientific concepts.
2. Your team will use and apply scientific methods that we've learned this year to solve this problem.
3. To continue to improve on cooperative lab group skills, and learn the value of teamwork. Your success and grade will depend on how well your construction team can manage the time and materials given.

Parts of the Project:

1. Asking the question and/or defining the problem.
2. Doing background research and developing a hypothesis.
3. Designing an experiment to test the hypothesis.
4. Conducting the experiment and collecting data.
5. Analyzing the data
6. Communicating the results of the experiment.

Requirements

Individual Requirements:

1. **(Daily Grade)** Research all topics on force, motion, and energy concepts. Take notes in bullet format.
2. **(Test Grade)** Write a background information report and works cited page, that consists of *at least* 1 paragraph per topic and a works cited page (bibliography) listing all of the sources used in the preparation of the report.
3. **(Lab Grade)** Analyze the data.
4. **(Lab Grade)** Write a 5 paragraph conclusion.
5. **(Test Grade)** Keep a daily journal that includes:
 - a. Daily building procedures (how it was done).
 - b. Problems that were encountered.
 - c. How problems were solved.
 - d. Next steps.
6. **(Lab Grade)** Turn in completed lab report.

Team Requirements:

1. **(Double Lab Grade)** Build a mouse-trap car that meets all criteria using only the required materials.
2. **(Lab Grade)** Test your mouse-trap car and **collect data** on a **chart** and then **graph it on a computer using Excel (Print out a graph) if available.**

Tasks to be completed every day:

- ❖ DAILY Journal Reports in each individual journal **(each team member).**
- ❖ Materials list updated daily.

FINAL Written Lab Report (one per group):

Includes these items in this order:

1. Title page
2. Question or Problem
3. Purpose
4. Background Information report
5. Hypothesis
6. Materials list
7. Variables List (Independent variable, dependent variable, controlled variable)
8. Step by step procedure
9. Data charts
10. Data graph of average speeds for your mouse-trap car
11. Data analysis
12. Conclusions: (5 paragraphs)
 - a. Answers the original question
 - b. Gives the results (data chart and graph) from your experiment.
 - c. Explains the meaning of those numbers.
 - d. Explains what your group learned from this lab about how a mouse-trap car works.
 - e. Gives at least 2 ways that the information from this experiment can be applied and another 2 ways that the project could be expanded (by showing what could/should have been done differently).
13. Works Cited page in correct format.

Due at the end of the Period Thurs. May 12th or Fri. May 13th (depending on A/B schedule)

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Grading:

Grades will be taken on each of the following:

1. Research Notes and Rough Draft of works cited – Daily Grade.
2. Background information report in correct format – Test Grade.
3. Final Written Report – Lab Grade.
4. Daily Journal –Test Grade.

Please note that purchase of a Mouse-trap Car is NOT necessary for completion of this project. Students may work in a small group with another student who has purchased a car, with the stipulation that the owner keeps the car upon completion of the project.

Mouse-Trap Car Written Work

<i>Requirement</i>	<i>Possible Points</i>	<i>Points Earned</i>
Research Notes & Works Cited	100	
Background Information	100	
Journal	100	
Written Report	100	
❖ Hypothesis	20	
❖ Materials List	20	
❖ Chart	20	
❖ Graph	20	
❖ Conclusion	20	

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Part 1

Asking the Question and Defining the Problem

The Problems: Choose one to test

1. To determine the effect that mass has on the performance of a mouse-trap car.
2. The effect of friction on performance of a mouse-trap car.
3. The effect of racing surface on performance of a mouse-trap car.
4. The effect of any other modification (student choice – be creative) on the performance of a mouse-trap car. This could include changing the spring tension, location of the mouse-trap, changing the tire diameter, etc. to the mouse-trap

The Question:

State your choice of problem to test in the form of a question to be answered in your hypothesis.

For example, if choosing the first problem you could ask, "How does adding mass to a mouse-trap car affect the speed that it can achieve?"

Another way to say this is: "As you increase the mass of an object, does it affect the overall speed that can be achieved?"

Be prepared to answer your question after basic research into the forces and motion involved in a mouse-trap car, as a hypothesis (if-then-because format).

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Part 2

Doing Background Research & Developing a Hypothesis

Taking Notes:

The following terms are force and motion topics.

Definitions for terms are important. However, examples help explain the topics to that they are understood.

Using the following terms as keywords, locate definitions and examples of each.

Write in bullet format in your daily log (journal).

Your textbook is a good resource, as well as other print materials available from our library.

Motion

- ❖ History of Motion (the contributions of Isaac Newton)
- ❖ Reference points
- ❖ Distance
- ❖ Displacement
- ❖ Speed
- ❖ Calculating Speed
- ❖ Velocity
- ❖ Changing velocity
- ❖ Acceleration

Forces

- ❖ Force
- ❖ Inertia
- ❖ Mass
- ❖ Balanced Forces
- ❖ Unbalanced Forces
- ❖ Friction
- ❖ Gravity
- ❖ Mass and weight difference

The Laws of Motion

- ❖ History of Newton's Laws of Motion
- ❖ First law of motion (definition and example)
- ❖ Second law of motion (definition and example)
- ❖ Calculation of acceleration (definition and example)
- ❖ Third law of motion (definition and example)

Writing your Hypothesis:

Your experiment is an attempt to answer this question, **for example:** As you increase the mass of a moving object, does the change in mass affect the speed of the object?

Now that you have done some background research, what do you think the answer to this question will be? Why do you think this?

There are two parts to the hypothesis:

- ❖ What you think the answer will be
- ❖ Why you think this

What you think and why together are your hypothesis.

Begin your hypothesis with "It is hypothesized that if _____ independent variable _____, then _____ dependent variable _____, because _____ reason _____."

Reminder that your hypothesis must be testable (i.e. you must be able to gather data in the form of qualitative [gathered by observing with your senses] and quantitative [measured with tools and includes numbers] data).

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Part Three

Designing an Experiment to Test Your Hypothesis

Design and build a model mouse-trap car to test your hypothesis.

Follow these guidelines:

1. The race car must be *reasonable* and *successful*.
2. The race car must use a standard mouse-trap as its only force.
3. Be constructed using only ***approved materials***.
4. Be totally built and completed in time to collect data on the performance of the race car (May 2-6).

Construction materials and limits:

Your race car construction company will build a mouse-trap car using the following materials:

- ❖ One standard mouse-trap
- ❖ Wooden platform (usually comes with the kit)
- ❖ Sandpaper (for smoothing your race car and removing unwanted parts)
- ❖ Duct tape
- ❖ White glue (not hot glue)
- ❖ Small nails or brads
- ❖ Approved tires of your choice and provision (you may use what comes with the kit).

Some of the materials used are limited. ***Time*** to build is limited as well.

Time Management and Teamwork are the keys here!

Any other materials needed by you must be approved by the teacher first!

ALL BUILDING MATERIALS WILL NEED TO BE ACCOUNTED FOR ON A DAILY BASIS. A WRITTEN DAILY LOG (IN YOUR SCIENCE JOURNAL) IS REQUIRED.

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Part Four Conducting the Experiment and Collecting Data

After the Mouse-trap Car is built you will be responsible for carrying out your experiment and gathering your required and measured data.

Read all of the following directions carefully. Ask yourself these questions.

1. What am I trying to find out?
2. How will I measure what I find out?
3. How will I record what I measure?

Make a chart to record the data you collect as you test your race car **BEFORE** you begin collecting data. Have your teacher initial the chart.

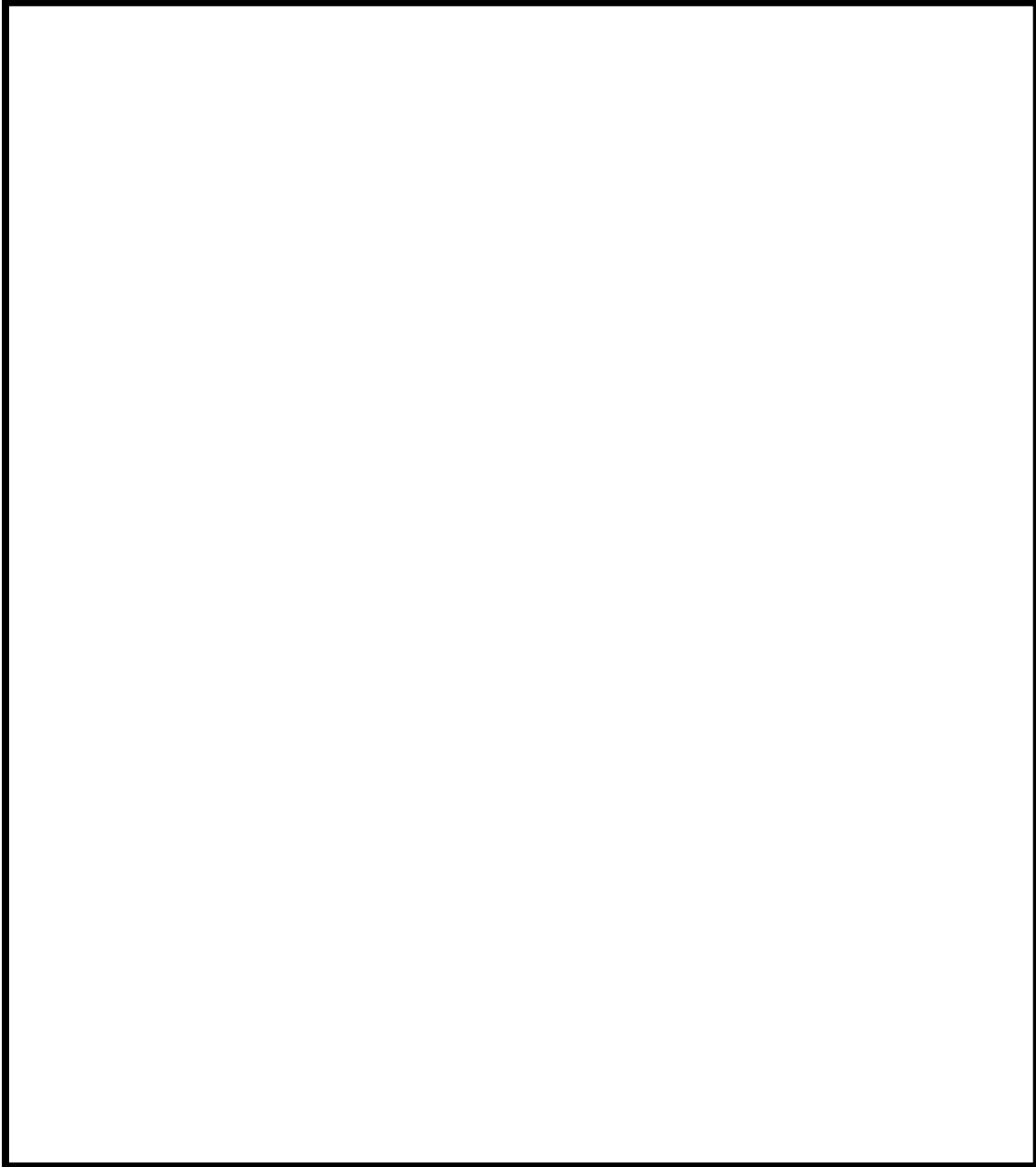
(Sample) Procedure for testing the Mouse-trap Car, with added mass being the independent variable.

1. Begin with the smallest bearing.
2. Tape the bearing to your Mouse-trap Car and set the mouse-trap.
3. At the signal, spring the trap and measure how far the car goes down the track laid out in the hall.
4. Record this data in your chart.
5. Repeat steps 2-4 **for a total of five times.**
6. Repeat steps 2-5 **with each bearing.**

Do not count trials that are incomplete – the bearing falls off.

Count trials where the car leaves the track – measure the distance from the beginning to where the car left the track.

Data Chart:



Teacher Initials:

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Part Five Analyzing the Data and Drawing Conclusions

Before you begin, answer the following questions:

1. What is the ***independent (manipulated) variable*** in this investigation?

2. What is the ***dependent variable*** in this investigation?

3. List variables that must be ***controlled*** in this investigation?

4. When you graph data, where is the independent variable on the graph?

5. Where is the dependent variable on the graph?

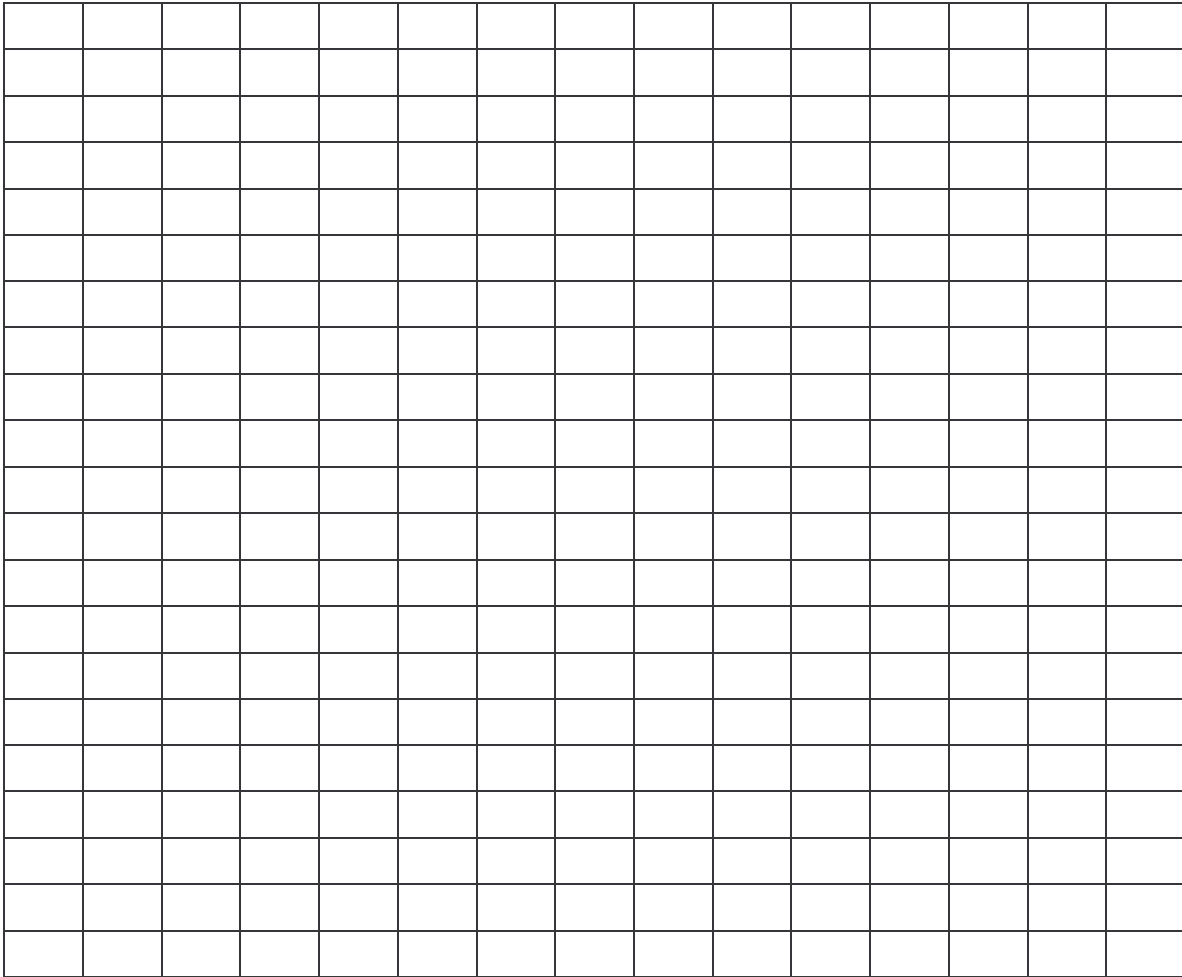
6. Look at the type of data you collected in this investigation. What kind of graph is best for this data?

Why?

Data Analysis:

On the back of this paper, make the appropriate graph of your data. Remember to include a title that describes the data, labels on each axis, and the unit(s) of measurement. Have your teacher initial the graph.

Graph:



Teacher Initials:

Now, use Excel to create a professional quality graph of your data.

Conclusions

Look at the graph carefully. What pattern or relationship do you see? In other words, what did the independent variable have to do with the dependent variable?

Written Conclusion:

The conclusion is a 5-paragraph discussion of the results and applications of the investigation.

Paragraph 1 – restates and answers the original question.

Paragraph 2 – explains and summarizes the data (results) of the investigation.

Paragraph 3 – explains and summarizes the data analysis.

Paragraph 4 – describes what was learned about force, motion and the way a Mousetrap Car works.

Paragraph 5 – describes at least 2 ways that the information from this experiment can be **applied** (used) and another 2 ways that the project could be **expanded** (by showing what could / should have been done differently).

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Part Six Communicating the Results

The results of your investigation will be communicated in a **Formal Lab Report**.

The lab report consists of:

1. Title page – your name and class period
2. Question
3. Background information
4. Hypothesis
5. Materials list
6. Building procedure (includes statement of variables)
7. Testing procedure
8. Excel chart
9. Excel graph
10. Data analysis
11. Conclusion
12. Works cited (use the format taught to you by Mrs. Morgan-Jones or Mrs. Carter)

Requirements

- ❖ Blue or black ink
- ❖ Only used one side of the paper
- ❖ No Liquid Paper, White-Out, or scratch outs
- ❖ If you word process the report (type), use Arial, Helvetica, or Times New Roman fonts, size 12 font, double-spaced.