

## Mouse Trap Car Project

**Purpose:** Construct a moveable machine that is powered by one mousetrap that will travel the greatest displacement.

**Rules:**

The machine must be handmade. It cannot come from a kit. No parts can come from a kit.

The mousetrap cannot be altered in any way except:

A maximum of 4 holes may be drilled to attach that trap to the machine, if necessary.

You may remove the trigger device.

The lever of the trap may be lengthened by securely adding material.

The machine cannot have any propulsion energy other than the mousetrap.

You may not use rubber bands or anything elastic to attach mousetrap to your drive axle

The trap must start the machine; no other motion will be permitted.

Distance measured will be displacement, NOT total distance traveled.

The straighter the vehicle goes the farther your displacement.

**The Contest:**

The contest will be held on a smooth level surface.

Each machine will be given three attempts to achieve the highest performance.

In case of a tie, one run off race will occur.

Each machine will be constructed based on research and experimentation of 2 or 3 people

Students will be required to build and test the machine.

Students are to collect the following information for a formal report:

Experiment with different wheel sizes.

Experiment with different lengths for the lever arm.

Mousetrap car, daily log sheets, and contest are lab scores.

Final Design drawing, and Formal Report are homework scores.

## Understanding 3<sup>rd</sup> class levers

Describe a 3<sup>rd</sup> class lever. (Where are the force, load and fulcrum located?)\_\_\_\_\_

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### Supplies:

- 1 standard Victor mousetrap
- 1 lever rod (your choice of material)
- Some string or fishing line
- 1 spring scale
- 1 permanent marker
- Some good tape

Attach a lever rod to the mousetrap.

Measuring from the pivot point of the trap, mark the lever rod at the distances in the data table

Attach mousetrap to table surface

Make sure spring scale is set to zero

Attach spring scale to lever rod

Rotate mousetrap spring 180 degrees and measure the amount of force the mousetrap supplies

Measure the force of the mousetrap at the marked distances on the lever rod.

Record forces in the data table

Enter and Graph your results on Microsoft Excel

(Use an X-Y scatter graph and connect the points)

(Distances should be plotted on the X-axis, forces on the Y-axis)

(label the axes)

Describe the relationship between the length of the lever arm and the force supplied by the trap?

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### Understanding 3<sup>rd</sup> class levers

	Force in Newtons (N)	
Lever arm Length	trial 1	trial 2
15 cm		
20cm		
25cm		
30cm		

# Mousetrap Car Designs Worksheet

(You may type this up if you want)

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Name of Website: \_\_\_\_\_

URL: \_\_\_\_\_

(Write neatly,

## Mousetrap Car Designs.

Find three mousetrap cars on the website that you think have a good design.

Copy and paste pictures here. (Resize them to make them small enough to fit)

## Mousetrap Car Performance.

If available on the website, copy the information about the above vehicles performance.

(Best distances)

## Mousetrap Car Materials.

Look at the designs on the website and list 3 or more materials that were used for each car.

Wheels: \_\_\_\_\_

Grip Material for wheels: \_\_\_\_\_

Chassis: \_\_\_\_\_

Lever Arm: \_\_\_\_\_

Other parts: \_\_\_\_\_

Connecting materials (holds vehicle together): \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

## Understanding Wheel and Axle

### Supplies:

2 different sizes of wheels

Wheel #1 description: \_\_\_\_\_

Wheel #2 description: \_\_\_\_\_

Ruler

Permanent marker

Tape

### Procedure

Place a mark on the edge of each wheel

Place a piece of tape on the table/floor as a starting mark

Place wheel mark on starting tape mark

Roll the wheel along until wheel mark is in contact with table again

Measure the distance traveled by each wheel as it goes through one revolution.

What happens to the distance traveled as the diameter of the wheel increases?

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Which wheel would require more force to make it turn?

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What would happen to the force required to make the wheel turn if the axle diameter is increased? (Think of the simple machine/levers chapter in the book)

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Design an experiment to test your axle diameter hypothesis. (Clear it with the teacher before testing)

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**Mouse Trap Car Project**  
(50 pts, graded using 6-traits)

**Lab Report** (typed, include the questions)

Why did you design your machine the way you did?

Where did you get your ideas?

Talk about your thought processes

What kind of data from experiments helped you with your decisions on your design?

What are two types of friction present?

What problems related to friction did you encounter and how did you solve them?

How many wheels does your car have?

What factors did you take into account to decide the number of wheels?

What kind of wheels did you use on each axle?

What is the effect of using large or small wheels?

Explain how Newton's first and second laws apply to the performance of a car?  
(pg 268-269 in text book)

Discuss the effect of the length of the lever arm in the pulling force of your car.

Discuss how the length of the lever arm is related to the power output of your car. What was the length of your lever arm?

Discuss the major problems encountered in the performance of your car and what did you do to solve them.

# Mouse Trap Car Project

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Daily log of activities (4 pts each day):

What goal do you hope to achieve today on your car?

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What job did each team member do today?

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What was accomplished on your mousetrap vehicle today?

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What clean up jobs did each team member do today?

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What will you try to accomplish tomorrow? (Do you need to bring materials?)

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# Mouse Trap Car Project

## Design process handout

List 3 possible items that can be used for wheels (3pts)

- 1.
- 2.
- 3.

How does the size of the wheels affect the distance the MPV will travel? (2pts)

**Project grading:**

Questions: \_\_\_\_\_ of 10

Thumbnail sketches: (3x5pts) ....\_\_\_\_\_ of 15

Design Matrix: .....\_\_\_\_\_ of 10

Top/Side View: .....\_\_\_\_\_ of 10

Labels and Quality: .....\_\_\_\_\_ of 5

Total:.....\_\_\_\_\_ of 50

In your own words, define chassis. (2pts)

What material will you use for your chassis? You must provide your own material. (1pt)

List any special supplies you may need. Check with your instructor.

Instructor's initials \_\_\_\_\_ (2pts)

Use the following page to brainstorm thumbnail sketches of your vehicles. (Remember the rules of the competition and the important design considerations you made)

**Design #1**

**Design #2**

**Design #3**

Select the best design by using the Design Matrix below  
 (Place numbers in to rate each design)

<b>4 – meets perfectly</b> <b>3 - meets well</b> <b>2 – meets somewhat</b> <b>1 - meets minimally</b> <b>0 – does not meet</b>	<b>Design #1</b>	<b>Design #2</b>	<b>Design #3</b>
<b>WHEELS</b>			
<b>AXLES</b>			
<b>HUBS</b>			
<b>LEVER ARM</b>			
<b>CHASSIS</b>			
<b>TOTALS</b>			

**Final Design Drawing:** be as detailed as possible with **labels of material, top view, and side view.** Use a ruler for improved quality

Top view (5pts)

Side View (5pts)

Names: \_\_\_\_\_

### Mousetrap Vehicle Testing Sheet

(All tests must be documented on a sheet. Use as many sheets as you need.)

Test # \_\_\_\_\_

How far did the vehicle travel? \_\_\_\_\_

What actually happened? Describe.

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What will you do to fix it?

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How far did the vehicle travel? \_\_\_\_\_

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