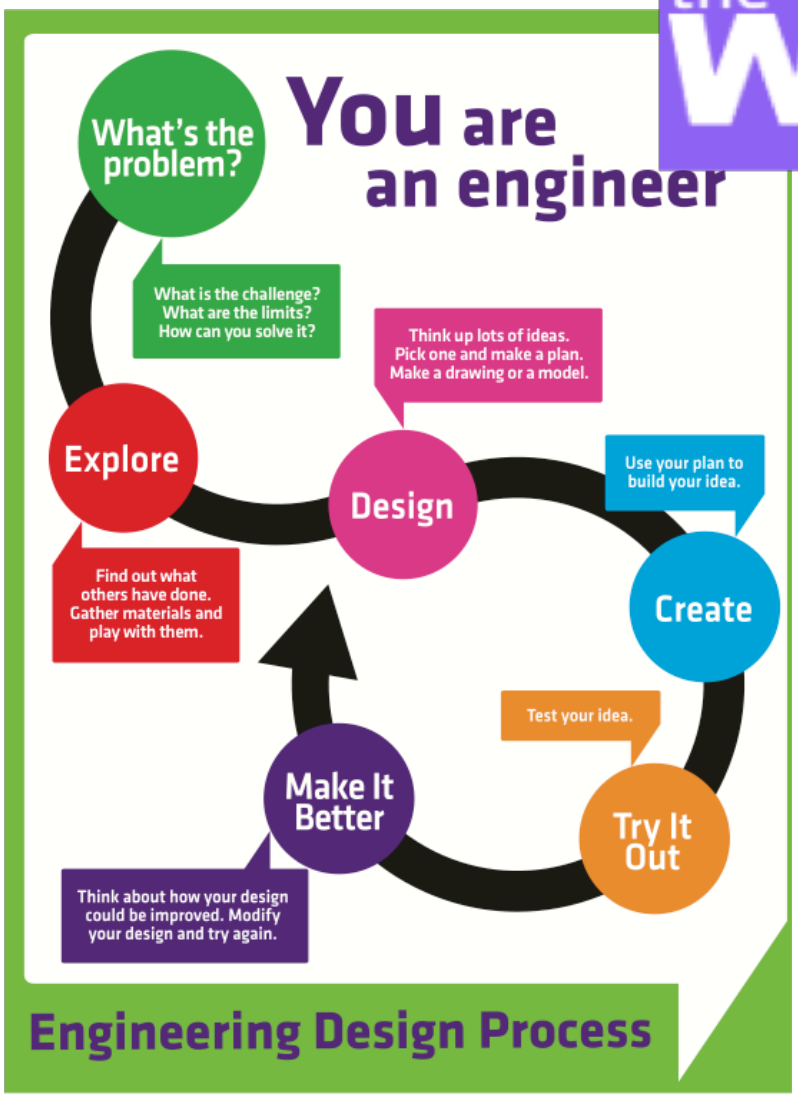
# Mousetrap CarProject




**Name:** _____

**Date:** _____ **Grade:** _____ **Section:** ____

# Mousetrap Car Project

## DESIGN CHALLENGE

**>>** Design and build a car powered by a mousetrap that will travel a minimum distance of 3 meters in a straight line.

### Criteria

*Your mousetrap car must:*

- Use a single mousetrap for propulsion
- Have a wooden base or chassis
- Travel a minimum of 3 meters (straight line)
- Have at least 3 wheels
- Have repeatable functioning (not breakdown)

### Constraints

*Your prototype must stay within these limits...*

- **Max Length -** 45 cm (front to back)
- **Max Width -** 20 cm (wheel to wheel)
- **Max Height** - 20 cm (floor to highest point)

### Approved Materials

- 1 Mousetrap
- 1 Wood base
- Rubber bands
- Mechanical fasteners (screws, screw-eyes, nails, etc.)
- Glue
- Plastic wheels or CD's
- Metal axle
- Tie wraps
- Fishing line/string
- Straws
- Other materials: (teacher approval needed)

***NOTE:** **Materials will NOT be given out** until a drawing is submitted with different views and an explanation of the design choice. **Points will be lost** if replacement parts are needed.

### Key Points

- Four wheels makes for a sturdy vehicle, but when there's more mass (like another wheel), it takes more force to move. A lot of mass is NOT good.
- Placing the mousetrap further from the back wheels will make the car roll further.
- The pull cord is a key component. As it unwinds, it pulls the car forward. You need a pull cord slightly shorter than your car.
- Without an axle hook the pull cord will just slip off the axle and the car will not move.
- A good loop knot in the end of the pull cord will not "Shrink" as it pulls on the axle hook causing it to get stuck.

Cars do not travel straight when the wheels are not (aligned) pointing in the same direction

### Competition Guidelines

- You will test and run your car on the track (floor). It will be 0.5 (1/2) meter wide.
- The distance the vehicle travels will be measured from the starting line to the front of the vehicle. If the vehicle leaves the boundaries of the track, the distance will be marked where any part of the vehicle leaves the track boundary.

**NOTE:** If you are absent on the day of the competition, you cannot compete in the tournament but must still demonstrate your car's ability to travel 3 meters in a straight line after you return.

### Key Terms

- **Alignment:** to be arranged in a straight line.
- **Chassis-**the base of the vehicle that all other parts are built upon.
- **Control-** changes the speed and direction of the vehicle.
- **Friction:** a fore that slows down an object.
- **Guidance-** gives the operator information to control the vehicle.
- **Propulsion-** makes the vehicle move.
- **Structure-**gives the vehicle is shape and size.
- **Suspension-** keeps the vehicle in contact with the road.

## IDENTIFY THE PROBLEM

*In your own words... state what you've been asked to do.*

I have been asked to _____ that will

_____

*Look at the rubric for this project on the last page and then answer the next two questions*.

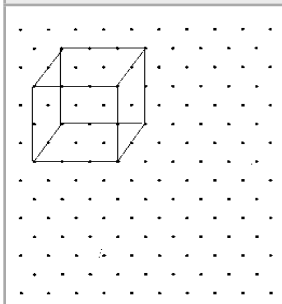
1. What do you think will be the most challenging part? _____

2. What's ONE strategy you can try to overcome it? _____

_____

## DEVELOP POSSIBLE SOLUTIONS

**Draw six DIFFERENT cars you think would work well for this design challenge.**

| Prototype #1 | Prototype #2 |
|---|---|
|  | |
| **Prototype #3** | **Prototype #4** |
| | |
| **Prototype #5** | **Prototype #6** |
| | |

## CHOOSING A SOLUTION

Identify which prototype you've chosen to make and explain why. ***If you really can't tell me why this prototype is insanely great, you shouldn't be building it.***

*A paragraph has a beginning a middle and an end.*
*The **beginning,** or the topic sentence, states what the paragraph is about.*

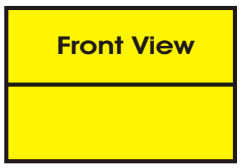
*The **middle** develops the idea in detail by giving specific support & details for it (usually 3 - 5).*

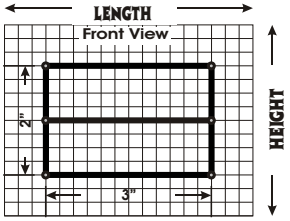
*The **end** (conclusion) restates the main idea in the topic sentence.*

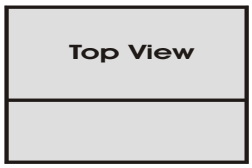
## CHOOSE A SOLUTION

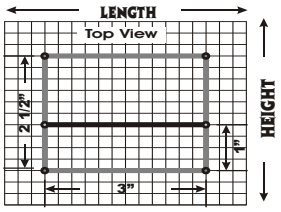
You need to create clear, specific and labeled drawings (using rulers and other drawing instruments) from three different views (front, top and side). Label the dimensions like the examples below.

**You will not be able to build until the drawings are completed.**

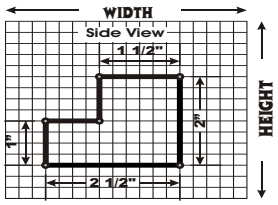







## Orthographic Production Drawings

### Front View

### Top View

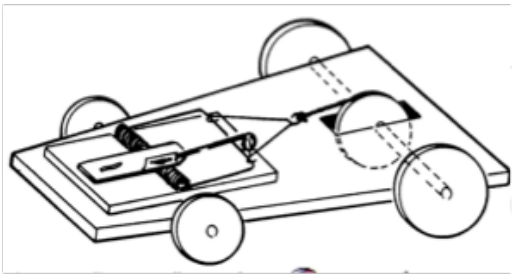
### Materials Needed

*(Ex. 1 piece of cardboard 2'x3')*

### Tools Needed

### Side View

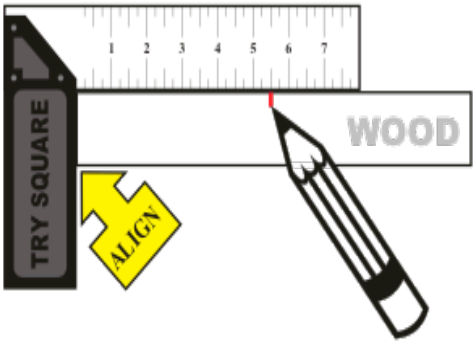
design & build



## STEP 1

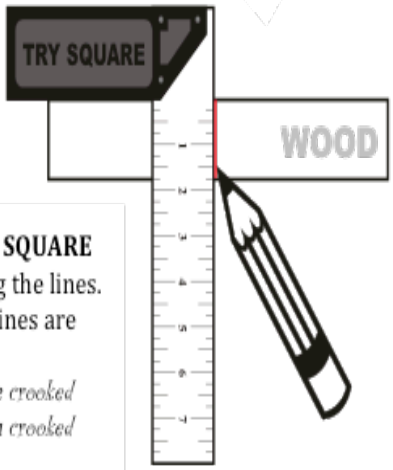
### PREPARING THE CHASSIS

Use a **TRY SQUARE** to draw lines on the **CHASSIS** with a pencil. If you want a curved line, use a **PROTRACTOR**. *Skip this step if you do not want to change the shape* and go to STEP 4.




## STEP 2

### PREPARING THE CHASSIS

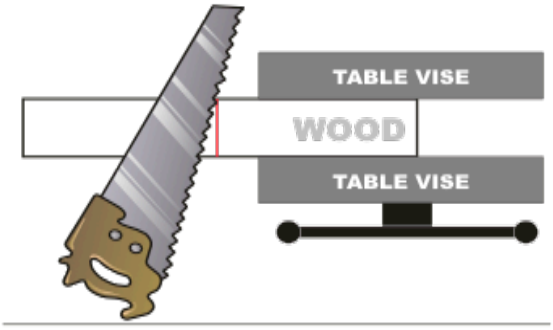



Rotate the **TRY SQUARE** to finish making the lines. Make sure the lines are straight.
***NOTE**: If you have crooked lines, you'll have a crooked chassis.*

## STEP 3

### PREPARING THE CHASSIS

Put the **CHASSIS** in a **TABLE VISE** or clamp it to the table with a **HAND CLAMP**. Use a **HAND SAW** to cut along the line. DON'T put a lot of pressure on the saw or it will bind up and get stuck.




## STEP 4

### PREPARING THE CHASSIS

Use **SANDPAPER** or a **SANDING BLOCK** to smooth all surfaces of the **CHASSIS**

## STEP 5

### *ATTACHING THE TRAP*

Use a **DRILL** to make a small **PILOT HOLE** in *EACH CORNER* of the mousetrap. This will let you screw the mousetrap to the **CHASSIS** without splitting the wood.


## STEP 6

### *ATTACHING THE TRAP*

**BEFORE** you drill holes, put a **DRILL BIT** into the **DRILL** that's **SMALLER** than the screws you will use.

## STEP 7

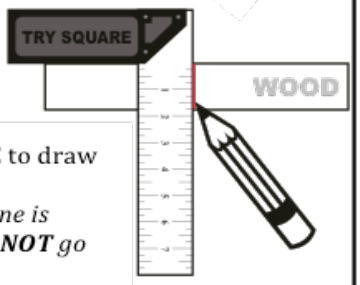
### *ATTACHING THE TRAP*

Screw the mousetrap to the **CHASSSIS** with a **SCREWDRIVER.**

**> IMPORTANT:** Make sure the **RED "V"** points to the **DRIVE** (back) **WHEELS.**


## STEP 8

### *INSTALL THE AXLES*

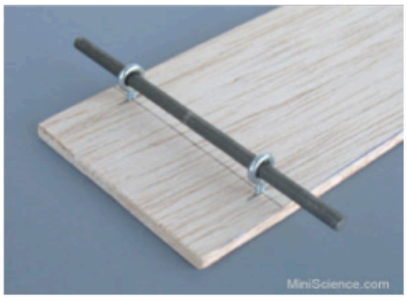



Use the **TRY SQUARE** to draw a line for each axle.
***> IMORTANT:*** *If the line is crooked, your car will* ***NOT*** *go straiaht.*

## STEP 9

### *INSTALL THE AXLES*

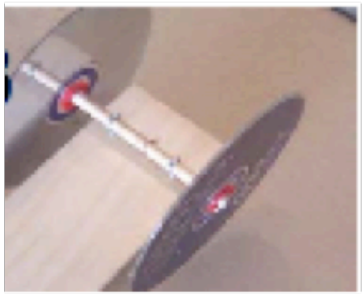
Put 2 **SCREW EYES** on the axle line and turn them until they are tight. Slide the **AXLE** through them. Do the same thing for the other **AXLE.**




## STEP 10

### *ATTACH THE WHEELS*

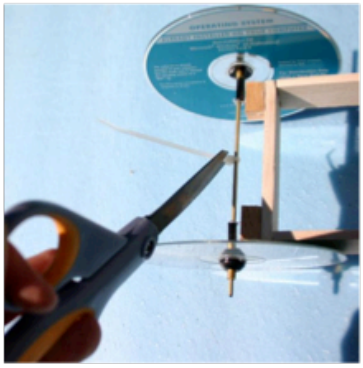
Attach the front and back wheels by gently tapping them on with a **HAMMER.** Spin the wheels with your finger to check for wobbling (that's not good).



## STEP 11

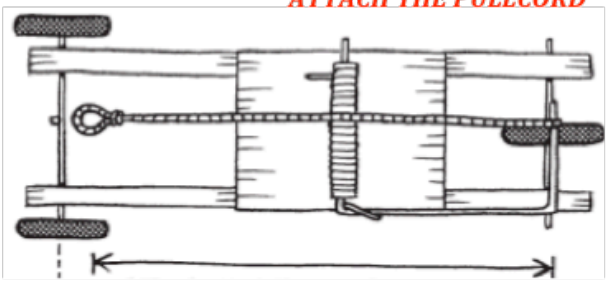
### ATTACH THE AXLE HOOK

Get a plastic **TIE WRAP** and wrap it around the **DRIVE** (back) **AXLE.** Cut off the extra section.



## STEP 12

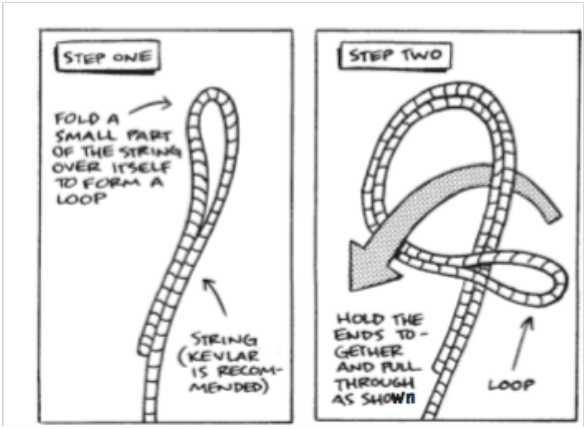
### ATTACH THE PULLCORD



Cut a piece of **FISHING LINE** for the **PULLCORD.** It should be a little bit shorter than the length of the car.

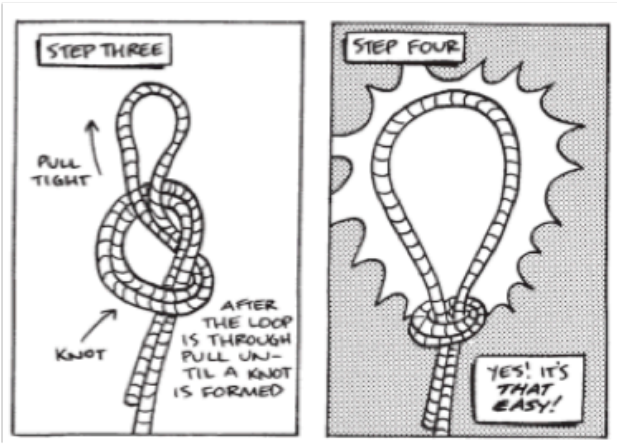
## STEP 13

### ATTACH THE PULLCORD



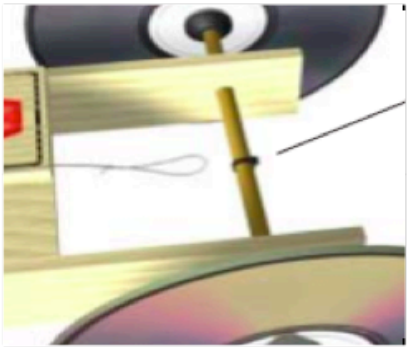

## STEP 14

### ATTACH THE PULLCORD




## STEP 15

### ATTACH THE PULLCORD



The loop you made will go over the **AXLE HOOK** and will spin the **AXLE.**

## STEP 16

### MAKING IT GO!

Tie the **PULL-CORD** to the **LEVER ARM** of the mousetrap.

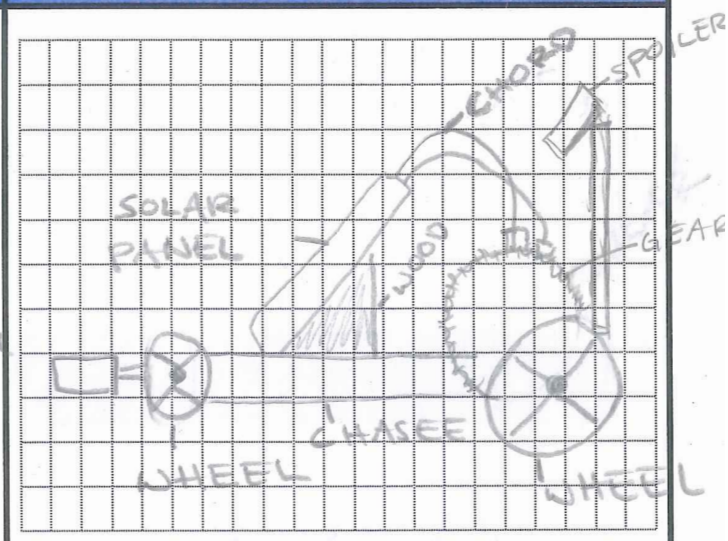
Attach the other end of the **PULL-CORD** to the back **AXLE** by looping it over the **AXLE HOOK.**

Wrap the **PULL-CORD** around the **DRIVE AXLE** by pulling the **LEVER ARM** back and turning the back wheels until you can't go any further.

Set the trap, put the car on the ground and SNAP! Watch it go!

## BUILD A PROTOTYPE

### EXAMPLE

| On the lines below, describe what you did. Mention any difficulties you had or any design changes you made. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #5: Date:** 5/3/12<br>Today I finished attaching the motor. I had a hard time w/ the gears because the the gear with the gray motor is to big so I changed it to a little smaller instead. I also used a velcro instead of glueing the motor on the car. Today my car is pe- |  |
| ❑ **YES** I described the drawing in a clear and understandable way<br>❑ **YES** I used key terms and information to accurately describe my progress and drawing. I have enough information.<br>❑ **YES** My description is neatly written and legible. | ❑ **YES** My drawing is large enough to show all the details.<br>❑ **YES** My line quality is sharp and precise (no smudges)<br>❑ **YES** My labels are outside the drawing and accurate<br>❑ **YES** My drawing uses shading for highlights |

| Describe what you did today. Mention any problems you had, design changes or questions. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #1 Date:** _____ | |
| **YES** I used complete sentences to describe my progress<br>**YES** My description is neatly written and legible<br>**YES** I used key terms when possible | **YES** My drawing is large enough and centered in the space<br>**YES** My line quality is sharp and precise (no smudges)<br>**YES** Labels and dimensions are OUTSIDE the drawing |

| Describe what you did today. Mention any problems you had, design changes or questions. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #2 Date: _____**<br><br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | |
| **YES** I used complete sentences to describe my progress<br>**YES** My description is neatly written and legible<br>**YES** I used key terms when possible | **YES** My drawing is large enough and centered in the space<br>**YES** My line quality is sharp and precise (no smudges)<br>**YES** Labels and dimensions are OUTSIDE the drawing |

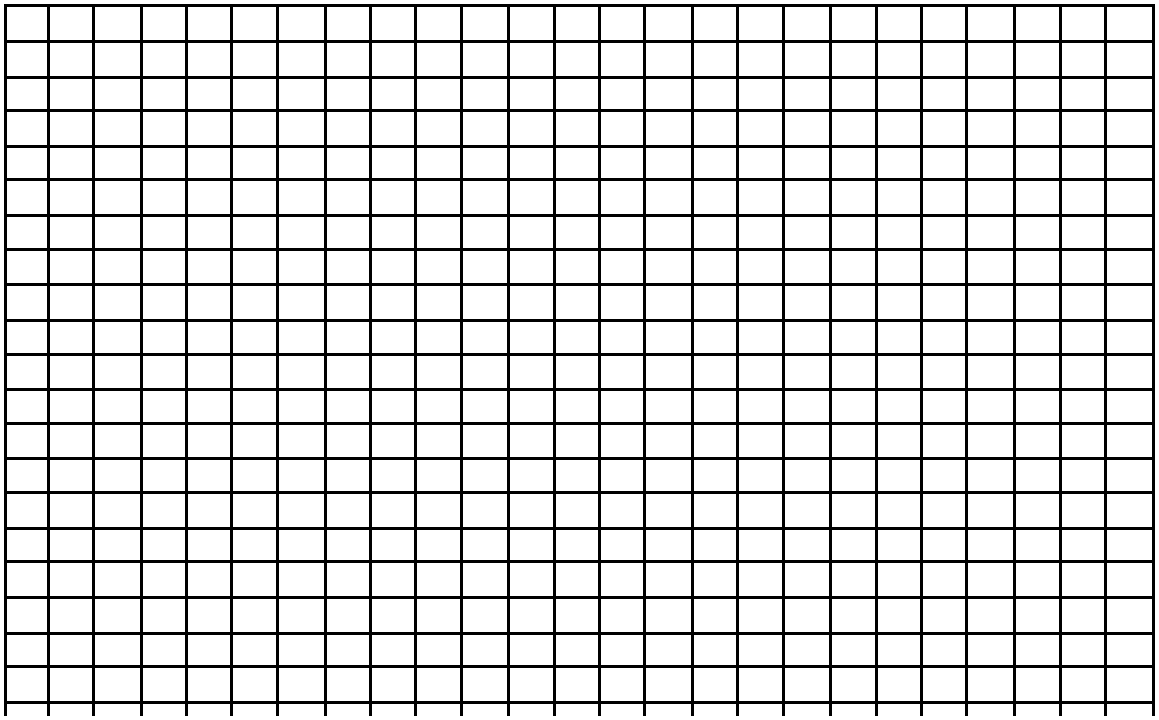
| Describe what you did today. Mention any problems you had, design changes or questions. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #3 Date: _____**<br><br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____<br>_____ | |
| **YES** I used complete sentences to describe my progress<br>**YES** My description is neatly written and legible<br>**YES** I used key terms when possible | **YES** My drawing is large enough and centered in the space<br>**YES** My line quality is sharp and precise (no smudges)<br>**YES** Labels and dimensions are OUTSIDE the drawing |

| Describe what you did today. Mention any problems you had, design changes or questions. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #4 Date: _____** | |
| **YES** I used complete sentences to describe my progress<br>**YES** My description is neatly written and legible<br>**YES** I used key terms when possible | **YES** My drawing is large enough and centered in the space<br>**YES** My line quality is sharp and precise (no smudges)<br>**YES** Labels and dimensions are OUTSIDE the drawing |

| Describe what you did today. Mention any problems you had, design changes or questions. | Make a labeled sketch that shows what you did. |
|---|---|
| **LOG #5 Date: _____** | |
| **YES** I used complete sentences to describe my progress<br>**YES** My description is neatly written and legible<br>**YES** I used key terms when possible | **YES** My drawing is large enough and centered in the space<br>**YES** My line quality is sharp and precise (no smudges)<br>**YES** Labels and dimensions are OUTSIDE the drawing |

## TEST YOUR PROTOTYPE

| Mousetrap Car Distance Trials | | | | | |
|---|---|---|---|---|---|
| **Trial** | **Distance (m)** | **Moved forward and straight** | **Moved forward but curved** | **Moved backwards or sideways** | **Did not move** |
| **1** | | | | | |
| **2** | ___ +<br>___ -- | | | | |
| **3** | ___ +<br>___ -- | | | | |
| **4** | ___ +<br>___ -- | | | | |
| **5** | ___ +<br>___ -- | | | | |



## COMPLETE DECISION

**My prototype's performance was**: (Check one)

___ **Exceptional:** it worked every time it was tested and needed no repairs

*Some reasons for this are:*

1. _____
2. _____
3. _____

___ **Very good**: it worked most of the time it was tested and didn't need any (or many) repairs

*Some reasons for this are:*

1. _____
2. _____
3. _____

___ **Good:** it worked some of the time it was tested and needed repairs

*Some reasons for this are:*

1. _____
2. _____
3. _____

___ **Not good:** it didn't really work

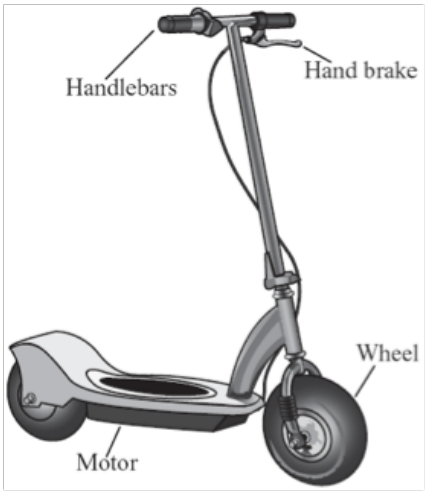
*Some reasons for this are:*

1. _____
2. _____
3. _____

| **Things that I redesigned (changed)** | **What the changes did** |
|---|---|
| 1. _____ | 1. _____ |
| 2. _____ | 2. _____ |
| 3. _____ | 3. _____ |

| **Things I'd do differently next time** | **What these might do** |
|---|---|
| 1. _____ | 1. _____ |
| 2. _____ | 2. _____ |
| 3. _____ | 3. _____ |

## OPEN RESPONSE: MAKING THE SNEAKER




All transportation vehicles have sub-systems or parts that work together to make them go. The scooter on the left has a motor for **PROPULSION,**A handle bar for **GUIDANCE**, a hand brake for **CONTROL** and a wheel for **SUSPENSION**.

**A)** Identify each of the same sub-systems parts in your mousetrap car.

**PROPULSION: _____**

**GUIDANCE: _____**

**CONTROL: _____**

**SUSPENSION: _____**

B) Explain why the size of your wheels and what they're made of is important.

_____

_____

_____

_____

C) Discuss the importance of your car's shape and how it will help it be successful.

_____

_____

_____

_____

# Cereal Box Project

**Name:** _____

**Date:** _____ **Grade:** _____ **Section:** _____

| **GOAL #1:** I CAN apply the Engineering Design process to imagine, plan and build solutions to situations involving bioengineering. | | | | |
|---|---|---|---|---|
| ***This is how I'll do it...*** | | | | |
| ***a.*** *I will make a collection of isometric concept drawings that shows different ways to solve a problem. [p.3]* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***b.*** *I will have an explanation for my "best idea" with specific reasons and supporting details. [p.4]* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| *c. I will make three-view orthographic drawings of my "best idea" with measurements & labels that others can follow. [p.5]* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***d.*** *I will complete open response question(s) about transportation technology & engineering [p.14]* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***e.*** *I will keep track of my progress and design changes by completing engineering logs during the project.* | | | | |
| **Engineering Log #1** [p.9] | | | | |
| 0 | 1 | 2 | 3 | 4 |
| **Engineering Log #2** [p.10] | | | | |
| 0 | 1 | 2 | 3 | 4 |
| **Engineering Log #3** [p.11] | | | | |
| 0 | 1 | 2 | 3 | 4 |
| **Engineering Log #4** [p.12] | | | | |
| 0 | 1 | 2 | 3 | 4 |
| **Engineering Log #5** [p.12] | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***f.*** *I will collect and display data about my prototype and use it to evaluate how well it worked. [p.13]* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| | | | | **Final Score** |

| **GOAL#2:** I CAN select and judge which tools, materials and methods are the best and safest to use when making a prototype. | | | | |
|---|---|---|---|---|
| ***This is how I'll do it...*** | | | | |
| ***a.*** *I will wear safety goggles and follow all safety procedures in the workshop* ***without*** *reminders.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***b.*** *I'll keep track of my materials and not need any replacement parts.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***c.*** *I will clean up my work space and put tools and materials back where they belong.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***d.*** *I will pass the tool-use license test(s) for this project.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| | | | | **Final Score** |

| **GOAL#3:** I CAN explain and defend my reasons for the tools and materials I use when building prototypes. | | | | |
|---|---|---|---|---|
| ***This is how I'll do it...*** | | | | |
| ***a.*** *I will follow my production drawings and building guide to make cardboard furniture fit for an "average" middle school student.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***b.*** *I will build a prototype that looks like a finished product without any loose parts, damaged or rough surfaces, dents, gouges or globs of glue.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| ***c.*** *I will build, test and demonstrate a prototype that is sturdy, holds together and doesn't need repairs between multiple uses.* | | | | |
| 0 | 1 | 2 | 3 | 4 |
| | | | | **Final Score** |