MESA DAY

EXAMPLE - ENGINEERING LAB REPORT

Instructions: Use template to write the lab report for your MESA Project. Provide as much detail as possible in your report. The report must be typed. All graphs, tables and charts MUST be created Excel or MS Word. No hand drawn table graphs and charts are allowed. Citation must be in MLA Format. The lab reports are due a week before the MESA Day Prelims.

Lab Report Due Dates:

High School: February 26, 2023 11:59 p.m.

Middle School: March 5, 2023 at 11:59 p.m.

Lab Report received after the due date will receive a 25% deduction on the lab report score

TEAM MEMBERS NAMES: Catherine Douglas, Jane Doe, John White, Emma Smith

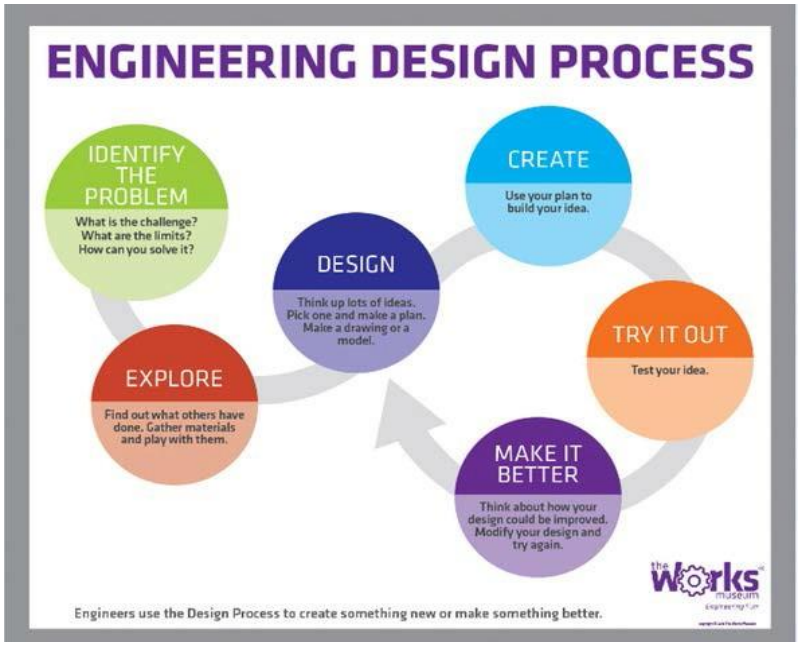
SCHOOL: UCLA Sample School

CENTER: **UCLA MESA Center**

MESA PROJECT: Mousetrap Car

GRADE: LEVEL (circle one): 6th 7/8th 9/10th 11/12th

Note: *This example lab report is to be used as a guide to assist you with writing your lab report. The "Best Practices", "Notes" in this sample lab report are helpful suggestions and should not be included in your final lab report.*



1. IDENTIFY THE PROBLEM

What is the challenge being worked on?

Best Practice: Write in full sentence. Don't be hesitant to modify or add to what you write as you progress through the process of completing the project.

Oct. 16, 2018
Our team will create a mousetrap cart compete in the 2019-20 MESA Day Preliminary competition. Our team will build a mouse trap car which is only powered by the lever of the mousetrap. The goal is to have the mousetrap go the farthest distance in the shortest amount of time.

Oct. 27, 2018
Based on the research we have completed , we will test the following criteria to determine how we will build the mousetrap car

a. Wheel Size
b. Lever Length
c. Length of Car Body
d. Wheel Friction (balloons on or off wheel)\
e. Weight of Mousetrap Car

What are the limits/constraints?

Oct. 16, 2018

The challenges the team members anticipate with building the mousetrap car are creating enough power to make the mousetrap car move at top speed.

Oct. 27, 2018
Determining which type of wheels will be best to allow the mousetrap to move as fast as possible. Should wheels be large or small?

Other things we need to consider when building the mousetrap

a. Weight
b. Length
c. Length of the lever
d. Frictions on wheels

How do you think you can you solve it?

Oct. 16, 2018

The team will create different prototypes with different, weight, lengths and different size wheels. After building the prototypes, wheel size will be tested for speed, time and distance to determine which will be the final model for the mousetrap car.

2. **EXPLORE-** Find out what others have done (research). Clearly list at least 5 sources using MLA citation format (web pages, articles, books, etc.). Identify (cite) and describe each source with one or more sentences.

Source #1

Citation: Thelemarck, C., "Build a Mousetrap", *Instructables*, Autodesk, Inc., 27, Oct. 2019, *https://www.instructables.com/id/Build-a-Mousetrap-Car/*

Description: This site provides step-by-step instructions on how to build a mouse trap car. Additionally, the site provides videos and a materials list.

Source #2:

Citation: "Build A Mousetrap Car", *Home Science Tools*, Home Science Tools. 27 Oct. 2018, *https://learning-center.homesciencetools.com/article/build-a-mousetrap-powered-car/*

Description: This site provides step by step instruction on how to build mousetrap car. The website provides things to think about when building a mousetrap car. Things to consider are wheel-to axle ratio, inertia, and rate of energy and fiction.

Source #3:

Citation: wikiHow Staff, "How to Build a Mousetrap Car". *wikiHow*, wikiHow, Inc. 27 Oct. 2018, *https://www.wikihow.com/Build-a-Mousetrap-Car*

Description: This site provide step by step instructions on how to build a mousetrap car. The site also provides a list or supplies needed and videos showing how to build the mousetrap car.

Source #4:

Citation: Harder, Theodore. "Modeling the Physics of A Mousetrap Car". *CTE Online*. Butte County Office of Education CET Center, 27 Oct. 2018 *https://cteonline.org/curriculum/lessonplan/modeling-the-physics-of-the-mousetrap-car/J3bA0K*

Description: The website provides lessons and activities associated with the physics of a mousetrap car.

Source #5:

Citation: Young, Hugh D. , Roger Freedman. University Physics. Vol. 2. Pearson Education, Inc., 2012

Description: The book explains the various physics phenomenon associated with the mousetrap car and provides formulas to calculate speed, kinetic and potential energy , frictions, etc.

3. **DESIGN -** Brainstorm ideas (at least 3) and record them. Write 2-3 sentences describing your idea. Make sure to include a sketch or drawing for each.

Best Practice: In your write up, be specific and provide as much detail as possible. Write in full sentences.

Idea #1

Make a mouse car using the following items, Balsawood, CDs. mouse trap, straws, wooden dowels, balloons and string.

This mousetrap will have a long body and big wheels. We will place the mouse trap at different locations on the cardboard to determine how the speed and momentum are affected by the placement of the mouse trap.

We will change the wheels to small wheels and repeat the process to determine how the speed and momentum are affected.

We will also experiment with

a. different lengths of the lever used to release the spring of the mousetrap.
b. different surfaces with and without a balloon around the wheels.

Idea #2

Make a mouse car using the following items, balsawood, CDs, wheels, mouse trap, straws, wooden dowels, balloons and string.

This mousetrap will have a short body and big wheels. We will place the mouse trap at different locations on the cardboard to determine how the speed and momentum are affected by the placement of the mouse trap.

We will change the wheels to small wheels and repeat the process to determine how the sped and momentum affected.

We will also experiment

a. different lengths of the lever used to release the spring of the mousetrap.
b. different surfaces with and without a balloon around the wheels.

Idea #3

Make a mouse car using the following items, Balsawood, CDs, mouse trap, straws, wooden dowels, balloons and string.

This mousetrap will be used as the body of the car. Both big and small wheels will be used to build the car and we will test the car to determine how speed and momentum of affected.

We will also experiment with
a. different lengths of the lever used to release the spring of the mousetrap.
b. different surfaces with and without a balloon around the wheels.

Select one of the 3 ideas above and describe a plan for building it (at least 5 sentences).

The idea our team chose was idea #1. In testing the various prototypes, it had the fast time for moving the farthest distance. The following categories were testes and used to determine the idea chosen by our group.
The specification of the mousetrap car will be the following

Body: Mousetrap car on a 12" piece of balsa wood
Wheel Size: Small
Balloons on Wheels: Yes
Lever Size: 6 inches

Generate a list of materials for the prototype.

Mousetrap

String

Metal Rod

Wooden Dowels

1/8" eyehooks

Straws

Balloons

Glue

CDS

Small wheels

Balsa wood

Scissors

Hot Glue Gin

Tacky Glue

Clay

Xacto Knife

Plastic zip ties (small)

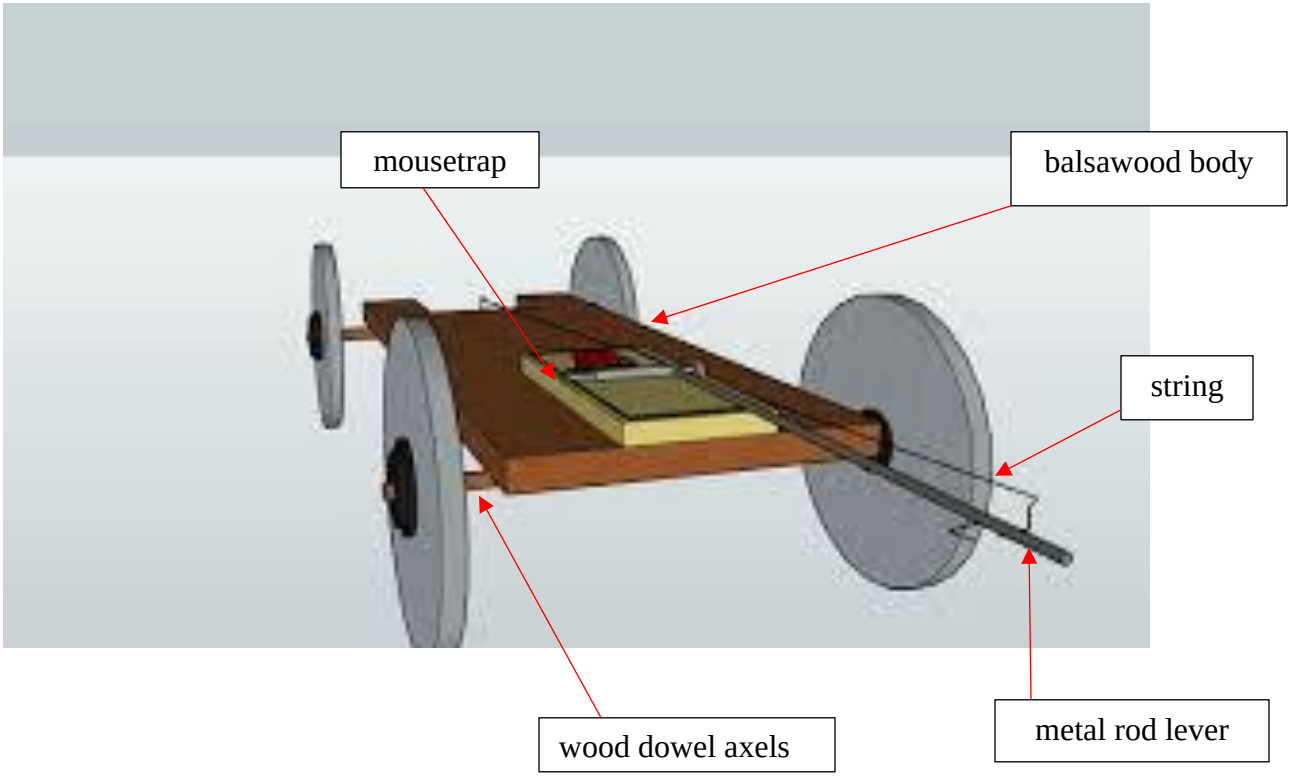
4. **CREATE -** Using your plan, build your prototype. Describe how the prototype was built in at least 5 sentences. Include a picture of the actual project prototype built.

Following is a description of how the prototype was built

1. A 3/16" balsawood was cut to 12 inches and the edges were sanded.
2. A 2 "square was cut out from each end of the balsawood.
3. Eye hooks were screwed and glued in the ends of each side of the balsawood.
4. Wood dowels were cut to 3 ¼" and placed in the eye hooks
5. The wheels were glued to the ends of each wooden dowels to create the wheels and axel of the mouse trap car
6. The metal rod was cut to 4" and zip tied to the side of the mousetrap arm.
7. The mousetrap was then glued to balsawood.
8. The sting is then tied to the metal rod and the back axel of the mousetrap car.
9. The back axel is then spun to wrap the string around the axel.
10. Balloons were cut horizontally and around wheels of mousetrap to create friction.

Prototype Image(s) – Copy and Paste image (s) below

Best Practice: Label all the parts of the inserted image to show how supplies were used



5. **TRY IT OUT -** Test your idea/prototype. Describe at least 3 trials/attempts. Use tables/charts as needed.

Best Practice: Provide and write a concise description in what was tested. Provide images if possible

Note: Only one test case was completed to give an example of what should be done. In the actual lab report teams are to submit, teams are responsible for completing all 3 test cases. Provide proof of results in the Graphs and Table section of the report.

Test #1

Criteria : Small wheels vs Large Wheels

We tried three different size wheels to use in the mousetrap car

1 3/8" diameter and 3/32" thick wheel

1 3/16 " diameter and 3/8" thick wheel

4 ¾ " diameter wheel

Results:

The 1 3/8"with 3/32 diameter thickness wheels were the best choice based on testing the three different wheels. See the chart below for testing results. The Graphs and Tables section of our engineering lab report display the results of our testing.

Test #2:

Criteria:

Results:

Test #3:

Criteria:

Results:

Graphs and Tables

Place charts, graphs and tables which provide information in your device. All graphs, charts and table MUST be create in Microsoft Excel or Microsoft Word.

Best Practice: Make sure all charts, graphs and tables are labeled with correct units and have titles, row and column headings which explain the graph, chart or tables.

Note: Only one test case was completed to give an example of what should be done. In the actual lab report teams are to submit, teams should provide, tables, graphs and charts for all three test cases.

Test Results – Wheel Size

Table headings and row/column labels to provide information on what is being measured

	3/8" diameter and 3/32" thick wheel			1 3/16 " diameter and 3/8" thick wheel			4 ¾ " diameter wheel		
	Distance (ft)	Time (sec)	Speed (ft/sec)	Distance (ft)	Time (sec)	Speed (ft/sec)	Distance	Time	Speed (feet/sec)
Test 1	120	45.8	2.620087336	100.45	30	3.348333333	10.33	20	0.5165
Test 2	92.5	30.5	3.032786885	99.56	25	3.9824	25	30	0.833333333
Test 3	73.3	30.3	2.419141914	70.16	46.7	1.50235546	50.5	45.6	1.10745614
Test 4	69.76	20.2	3.453465347	66	52.4	1.259541985	100.25	50.3	1.99304175
Test 5	150.25	60	2.504166667	40.9	33.6	1.217261905	66.167	30	2.205566667

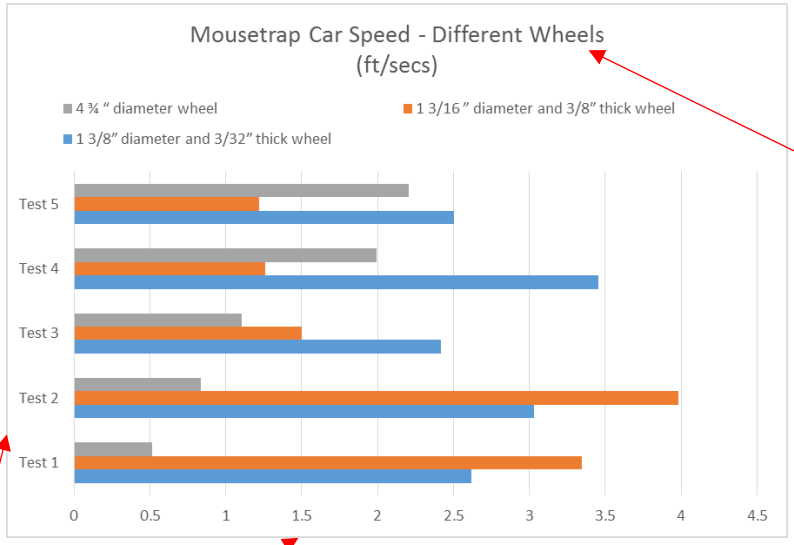
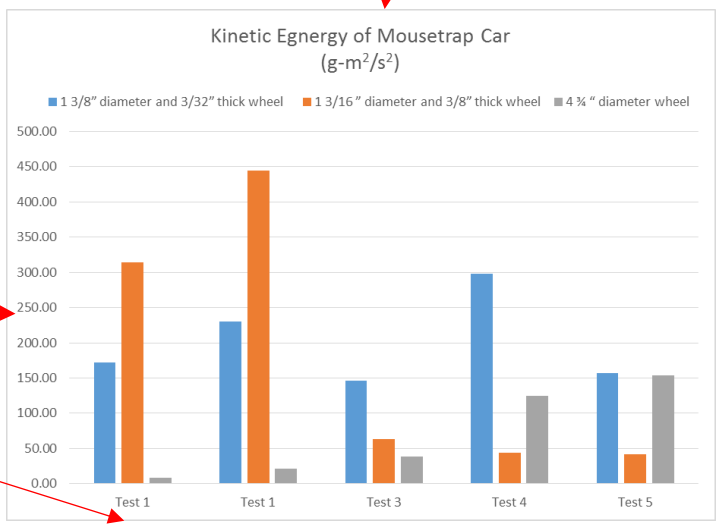


Chart Title and Measurement units



Axis labels on charts

Best Practice: Provide equations with name of equation and explain how equation was used. Define each variable and provide units of measurement. You can use equation editor in Microsoft Word or Google Docs to write equations.

Use of mathematical concepts/equations:

Applicable math concept/equation (state concept/equation):

Distance Equation: $\boldsymbol{d = r * t}$

$\boldsymbol{d}$ = distance (feet)

$\boldsymbol{r}$ = speed (feet/second)

$\boldsymbol{t}$ = time (seconds)

How was the concept/equation used?
(Demonstrate use of concept/equation as it pertained to project):

The distance equation was used to determine the speed of the mousetrap when it was tested with wheels of different size and thickness. The equation was manipulated to solve for $\boldsymbol{r}$ and this new equation was used to determine the speed of the mouse trap. The equation for $\boldsymbol{r}$ is provided below

$$r = \frac{d}{t}$$

Applicable math concept/equation (state concept/equation):

Kinetic Energy: $KE = {}^{1}/_{2}\ mv^2$

KE = Kinetic Energy
m = mass
v = velocity

How was the concept/equation used?
(Demonstrate use of concept/equation as it pertained to project):

The equation was used to measure the kinetic energy generated by the mouse trap lever when it was released. See the figure above to view the kinetic energy.

6. **MAKE IT BETTER -** How can you make the project better? What modifications do you plan to make *(state at least 5)?*

Modification/Improvement #1:

Option #1 to improve the mousetrap car is experiment with different size wheels on the front or the back of the mousetrap car.

Modification/Improvement #2:

Option #2 to improve the mousetrap car is experiment with different boy shapes of the mouse trap car

Possible option is a trapezoidal shape body to make the car more aerodynamic. The short side of the trapezoid would be the front of the car and the larger side will be in the back to allow the mouse trap to be mounted. The different ratios of the short side to the long side will be experimented with to determine the optimal shape of the trapezoid body.

Modification/Improvement #3:

Option #3 would be to experiment with different size axels to determine if this affect the speed of the mousetrap car.

Modification/Improvement #4:

Option # 4 would be to experiment with placement of the mouse trap on the car body to determine how this affects the speed of the mouse trap.

Modification/Improvement #5:

Option # 5 would be to experiment with how the length of the rectangular piece cut out from the ends of the mouse trap car body. This would reduce the weight of the mouse trap car and thus affect the speed of the mousetrap car.

Build and prepare a competition ready project. Include a picture/drawing below. Show different views of your project (top view, side view, front view etc.)

Note: The image below is an example. In the actual lab report this images should be of your teams completed project. If drawings were creating on CAD based software those drawing should be included in this section also.