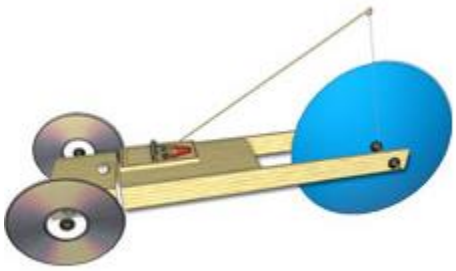
Engineering 11/12

Mousetrap Vehicle Challenge Brief



Team Name: _____

Team Members: _____ & _____ & _____

OBJECTIVE

You and a partners (teams of three) must design and build a vehicle powered by a single mousetrap with the intent to set a record for the longest distance travelled.

CHALLENGE PHASES

The challenge will occur in four phases:

1. Phase 1: Research and design.
2. Phase 2: Manufacturing & Testing
3. Phase 3: Compete
4. Reflect

CONSTRAINTS

Vehicles must adhere to the following design constraints:

1. Maximum overall length: 20 Inches
2. Maximum overall width: 6 Inches
3. Maximum overall height: 8 Inches (at start line)
4. Your vehicle must incorporate parts that have been CNC manufactured using at least two of the three machines available to you in the shop (3D printer; Laser; Router).

REGULATIONS

The challenge rules are as follows:

1. The vehicle must be powered by the mousetrap provided by your teacher.
2. The mousetrap may not be altered in any way other than removing the bait lever and locking arm and drilling holes to mount the trap to the car.
3. The vehicle may not start with any additional potential and/or kinetic energy other than what can be stored in the mouse trap's spring.
4. The spring may not be altered or wound tighter.
5. The vehicle must be self-steering (no outside assistance), distance will be measured in a straight line from start point to end point using the centerline of the front axle for datum.
6. Each car must be capable of three runs. The distances of each run will be averaged to determine final distance achieved.

APPROVED MATERIALS

Your vehicle can be constructed of any materials available. A selection of materials will be offered, but other materials (supplied by you) may also be suitable and if so, are permitted.

TIME LINE

Completion of a 'race-ready' design – 4 school weeks from today

Team: _____

Phase 1: Research & Design

The first phase of any project is the design phase. The design phase should follow a logical process. You will research and design by working through the following steps:

1. Use the internet to **research** mousetrap cars designs. Look for specific information on what makes for the best long-distance racer. Do not rely solely on YouTube, there are plenty of non-video resources out there.
2. Answer the Research and Development questions. These are to be submitted when done. One submission per team.
3. Make notes on what works the best, generate a list of points to consider when creating your design.
4. Decide on how you want your car to look:
    a. Make sketches using paper and pencil to work through design possibilities. Sketches can be made free hand and as much as they don't have to be extremely neat, they do need to be understandable to be meaningful. The addition of clarifying notes on your drawings can assist greatly with understanding. Your sketches will be assessed in the grading of this phase so they must be kept in an orderly fashion and all team members names should be on each piece of paper.
    b. Using 3D modelling software (CAD), create a reasonably accurate depiction of your design. Your current skill level in using this design software and your willingness to extend and build on your current skills will be a consideration during grading.
    c. Create dimensioned orthographic view drawings (like the gears) that include dimensions and clarifying notes.
5. **Submit the following** for assessment BEFORE building your car:
    a. Research Questions Completed
    b. Notes Page Completed – list of points to consider for good design
    c. Sketches – any sketches made when working through ideas/possibilities
    d. Orthographic Style Drawing of planned design, on 11x17 paper, printed in colour

Team: _____

Research Questions

Use the internet to answer the following:

1. Draw and label a first-class lever and give an example (show forces)

2. Draw and label a Second-class lever and give an example (show forces)

3. Draw and label a third-class lever and give an example (show forces)

4. Define Potential Energy _____

   _____

   _____

5. Define Kinetic Energy _____

   _____

   _____

6. Define Force _____

   _____

   _____

Team: _____

7. Define Friction _____

_____

_____

8. Define Torque _____

_____

_____

9. Define Power _____

_____

_____

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

_____

11. What's one strategy you can try to overcome this challenge? _____

_____

12. How do you intend to combat friction in your axles? _____

_____

/15

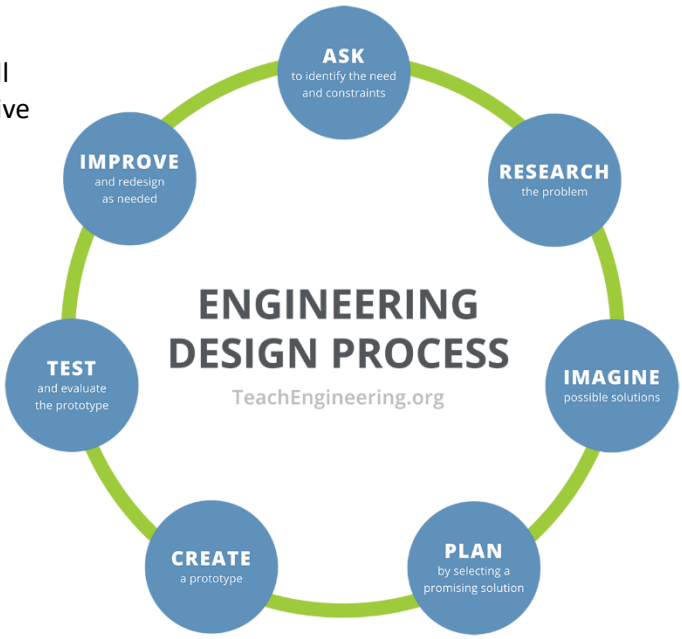
Team: _____

Thoughts: *What makes a good design for this assignment*?

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	

Phase 2: Manufacturing & Testing (*Iteration*)

1. You may construct your vehicle using the laser cutter, 3d printer, CNC router or any of the equipment you have been trained to use in the shop with teacher supervision.
2. Once the parts are complete, assemble the car
3. Test the car
4. Refine the car and make adjustments. Small tweaks can have a large impact (both positive and negative).
5. Test, Refine, Test, Refine, Test, Refine… (iteration)



Record the results of your testing in the table below

Test #	Result	Test #	Result
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	

Phase 3: Compete

Students will run their cars down the hallway under the following conditions:

1. Other students are still in class. Please be respectful to teachers and students that are in class. If you understand and agree to this, please initial in the space provided.

   (Students initials _____ _____)

2. Flat, unobstructed hallway.

3. The average of three (no more) runs will determine the distance achieved.

4. Final Score

   a. Run 1_____
   b. Run 2_____
   c. Run 3_____
   d. (1+2+3)/3=_____

Mousetrap Vehicle Competition

Marking

Research & Design Phase (25%)

Considerations:

- Completion of R&D Questions
- Completion of Notes Page
- Sketches – meaningful, informative
- Orthographic Drawing of Intended Design
- Teamwork – workload balanced, contributions

Manufacturing & Testing Phase (35%)

Considerations

- Safe Use of Tools & Machinery
- Build Quality and Appearance
- Incorporation CAD & CNC manufacturing (Fusion 360; 3D printing; Laser; Router)
- Form & Function (*build the best car in the world, but if it's ugly it won't sell!*)
- Evidence of multiple 'iterations' in effort to improve design
- Teamwork – workload balanced, contributions

Compete Phase (30%)

- 1st place = 30%
- 2nd place = 25%
- Others (*must demonstrated a valid effort*) = 20%

Reflection - Individual (10 %)

- a written response challenging you to reflect on the activity, your process and what you have learned along the way is to be submitted

Participation

It is expected that all students will contribute meaningfully to their team. In effort to encourage this, a reduced mark may be assessed for any students that under-contribute. Any student deemed to be in this position will see a grading penalty applied in the form of a percentage of the team's grade. The percentage factor will reflect observed contribution.

*Example: team achievement = 25/30… Contribution Assessment 80% … Adjusted Grade 25*80% = 20/25*