

**GUIDELINES FOR SECME ENGINEERING DESIGN COMPETITION
MOUSETRAP CAR**

**MIDDLE-HIGH SCHOOL
MOUSETRAP CAR
GUIDELINES**

Must have three (3) students on a team. All team members must be present at the event.
Maximum of three (3) teams per school.

**GUIDELINES FOR SECME ENGINEERING DESIGN COMPETITION
(MOUSETRAP CAR: CONSTRUCTION AND OPERATION)
MIDDLE AND HIGH SCHOOL DIVISION**

REQUIREMENTS

(Any entry not meeting the following requirements will be disqualified.)

The Mousetrap Car Engineering Design Competition **requires participation in these four areas:**

1. Mousetrap Car Construction and Run
2. Design Drawing of Mousetrap Car
3. Technical Report on Mousetrap Car (due in UCF Outreach Office by 4:00 pm February 4, 2011)
4. Team Interview with Judges

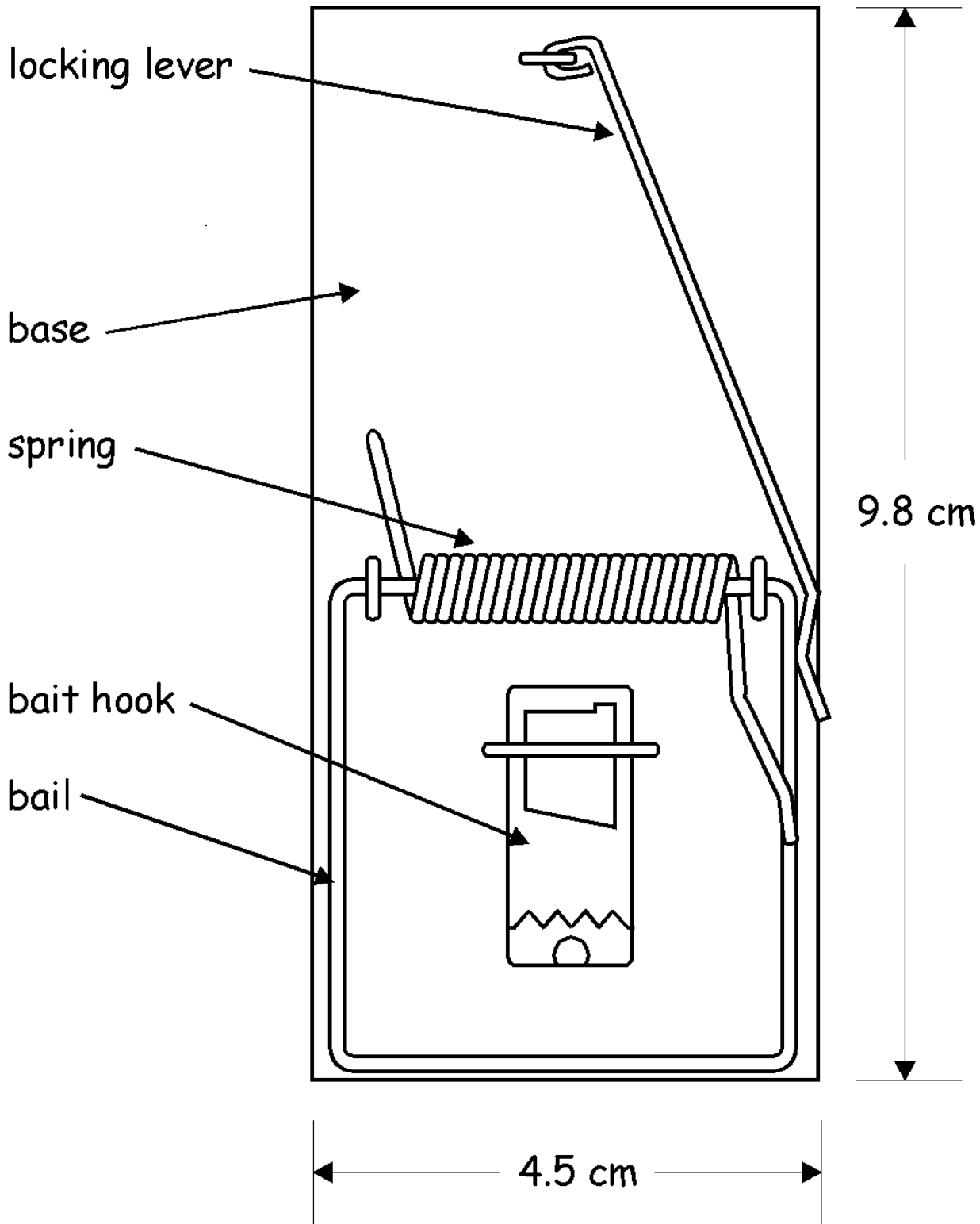
This is a **team competition** and should reflect the coordinated efforts of all members. **Three (3) students must be on each team.**

Each team member is expected to be able to serve as a spokesperson and be fully involved with all aspects of the entry.

CAR CONSTRUCTION AND DESIGN

1. **A standard mousetrap**--usually about 4.5 X 10 centimeters and weighing about 25 grams--**must be used to build the car.**
2. Components of the mousetrap are: base (on which other components are mounted), spring, bail, locking lever, and bait hook (see component sketch on next page).
3. The mousetrap spring must be the sole source of power. **(You may NOT use rubber bands, CO₂ boosters, or any other agent or element for extra power).**
4. **In design and construction of the car, the original mousetrap spring and wood base MUST remain intact.** These two components may **NOT** be cut or altered in any way— physically, chemically, or thermally. Only the locking lever and bait holder may be removed from the base, if desired. **The bail may be straightened but NOT cut (shortened), added on to, or reinforced. It must remain as a component of the completed car.**
5. The spring must be visible and/or accessible to the judges for inspection.
6. The car must have a minimum of three wheels and can be made as long or short as desired as long as requirement #4 above is met.
7. Cars will be tested on a smooth flat surface. **Distance is measured from the starting point to the stopping point of travel, utilizing a straight line to connect the two points.**
8. **There will be two runs for each car; the better run will be used for final scoring of the mousetrap car's performance.**

Standard Mousetrap Diagram



CALCULATING THE ENGINEERING DESIGN (MOUSETRAP CAR) SCORE

Performance Score

Two formulas are used to calculate the Performance score for the car run:

$$N = \left(\frac{w}{W}\right) X \left(\frac{D}{L}\right)^2 \quad \text{and} \quad F = \frac{N}{N_L} X 100$$

where:

N...is the score.

To ensure that cars actually perform and not just be small and light,

N=0 if D is LESS than 300 centimeters (for middle school/junior high teams)

N=0 if D is LESS than 600 centimeters (for high school teams)

w...is the mass of the original mousetrap (always taken as 25 grams). NOTE: At all competitions, this standard value will be used in calculating the Performance score.

W...is the total mass of the completed car in grams.

D...is distance measured from the starting point to the stopping point of travel, utilizing a straight line to connect the two points, in centimeters.

D=2,500 if the car travels 2,500 centimeters or more.

L...is the car's longest measurement along one of the three basic dimensions—length, width, or height—in centimeters, measured with the bail extended or retracted, whichever is greater.* **Please refer to MOUSETRAP CAR DRAWING EXAMPLE for more information on how to measure L.**

N_L...is the highest Performance score at the competition site.

F...is the final Performance score (to be combined with scores for the Design Drawing, Technical Report, and Team Interview).

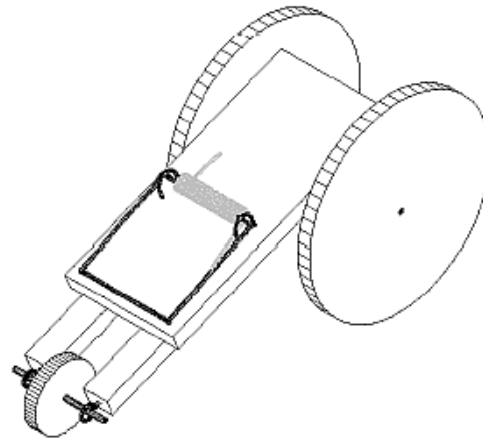
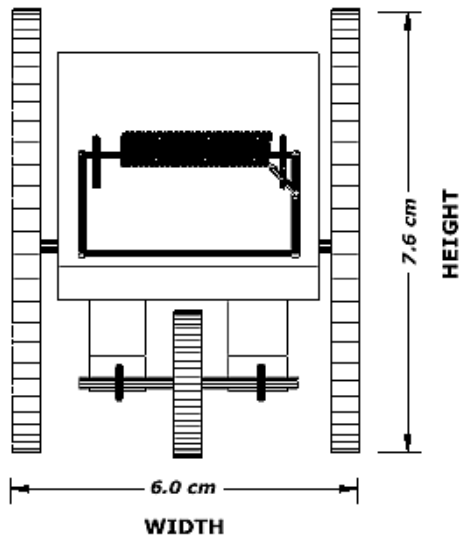
**Judges will measure "L" (see illustration on following page) and "W" prior to the mousetrap car Performance runs. These measurements, together with "D" (determined by the car's run), are used to calculate "N" in the formula above.*

Overall Team Score in competition is sum of:

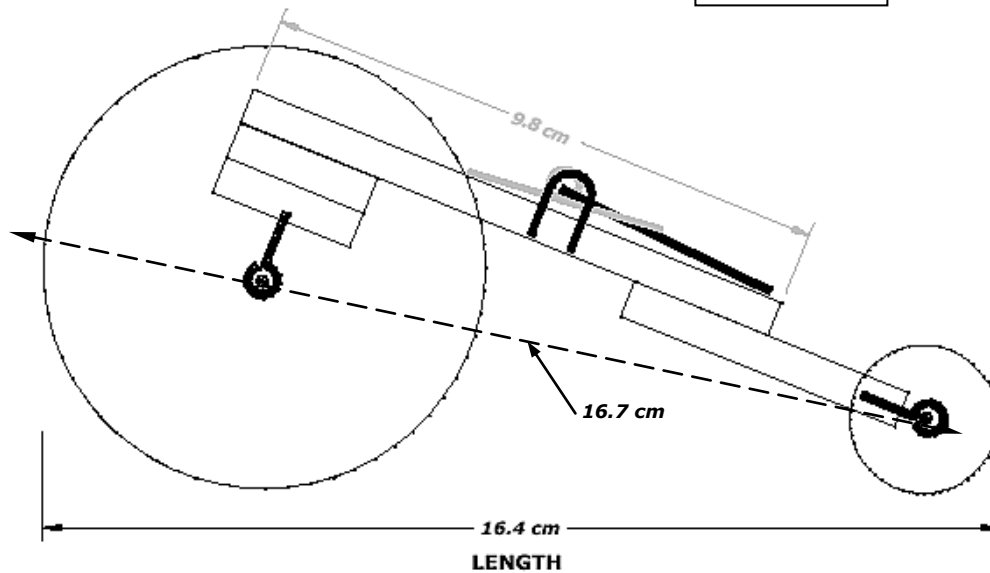
- 1) Performance (car run) as calculated above (max. 100 points)
- 2) Design Drawing (max. 50 points)
- 3) Technical Report (max. 50 points)
- 4) Team Interview (max. 50 points)

Thus the maximum total is 250 points.

**Measurement of “L,” the Mousetrap Car’s Longest Dimension
In Any Direction—Length, Width, or Height**



**SCALE
1.0:1.38**



“L” is the car’s longest measurement along one of the three basic dimensions—length, width, or height—in centimeters, measured with the bail extended or retracted, whichever is greater. The length of the car is defined as the distance from the farthest point at the rear of the car to the farthest point at the front. Likewise, the width of the car is defined as the distance from the farthest point on one side to the furthest point on the other. The height of the car is defined as the distance from the travel surface to the highest point of the car.

L (for this example) = 16.4 cm

**SECME ENGINEERING DESIGN COMPETITION:
MOUSETRAP CAR CONSTRUCTION AND OPERATION
(Evaluation Sheet)**

Please Check: Middle School High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name			
		Date	
Regional/State Sponsor			
Distance			
First Run		Second Run	

$$N = \left(\frac{w}{W}\right) X \left(\frac{D}{L}\right)^2 \quad \text{and} \quad F = \frac{N}{N_L} X 100$$

w = 25 Grams

W = [Measured weight, in grams]

L = [Longest dimension—length, width, or height—in centimeters]

D = [Maximum D=2,500 if measured distance is more than 2,500 cm]

N = [N=0, if D is LESS than 300 centimeters for middle school teams if D is LESS than 600 centimeters for high school teams]

N_L = [Highest Performance score at competition site]

Mousetrap Car Performance Point Score: F=

(Note: F is combined with scores for Design Drawing, Technical Report, and Team Interview to arrive at Overall Team Score in competition.)

SECME ENGINEERING DESIGN COMPETITION GUIDELINES: MOUSETRAP CAR DRAWING

As a part of the Engineering Design Competition, each team is required to prepare a scaled drawing depicting the car that they have designed and built.

MOUSETRAP CAR DRAWING REQUIREMENTS AND GUIDELINES: (Any entry not meeting the following requirements will be automatically disqualified.)

1. The Mousetrap Car Drawing entry is required to illustrate the actual mousetrap car built by the team (photographs and computer generated drawings will NOT be allowed).
2. The size of the engineering paper is required to be the standard 18" X 24" (plain, non-grid, (17-pound vellum) sheet. (Allowing for the required 1" border on all sides, the actual drawing is to cover an exposed area of 16" X 22" of the paper.) **NO MOUNTING, NO FRAMES ALLOWED. BUT DRAWING MAY BE LAMINATED FOR PROTECTION IF DESIRED.**
3. All dimensions are required to be illustrated on the drawing.
4. The scale and the units are required to be indicated on the drawing.
5. The team's Mousetrap Car Drawing is required to show front, side, and top views.
6. All parts of the car are required to be labeled.
7. Ink pens, pencils or markers may be used.
8. A title ***legend*** is to be drawn in the bottom left corner of the drawing inside the 1" border with the following information is required:

Team name
School Name
School District
Team Members' Names and Grade Levels
School Coordinator's Name
Date of Competition

AT ALL COMPETITIONS, THE MOUSETRAP CAR DRAWING WILL BE JUDGED ON:

RESEMBLANCE (Between the actual mousetrap car and drawing)
SCALE
NAMING/LABELING (of all of the parts used)
APPEARANCE/NEATNESS

**SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR WRITTEN TECHNICAL REPORT**

As a part of the Design Competition, the team is required to write a Technical Report describing the design, construction, and operation of the Mousetrap Car. The Technical Report should be a computer printed/typed document, **double-spaced**, on 8½" X 11" white paper with one-inch borders at the top, bottom, and on each side.

Use 12 pt. type in a standard legible text font. **The main body of the report -- 4. Introduction, 5. Design Construction, 6. Construction Procedure, and 7. Operation of the Mousetrap Car-- should be a maximum of 5 pages total.** Drawings, sketches, and tables may be included in an Appendix if desired but this is optional and not required. (Entries not meeting these requirements will automatically be disqualified).

TECHNICAL REPORT REQUIREMENTS AND GUIDELINES: (Any entry submitted without a cover page containing all of the required information will automatically be disqualified).

1. COVER PAGE
 - a. Title (SECME: Mousetrap Car Technical Report)
 - b. Name, grades, complete home address of team members
 - c. Team's school name and complete address
 - d. School System/district name
 - e. School Coordinator's name
 - f. Date (date of competition)
2. ABSTRACT One-half to one-page summary of Technical Report.
3. CONTENTS One page
4. INTRODUCTION
5. DESIGN
6. CONSTRUCTION PROCEDURE
7. OPERATION
8. CONCLUSION/RECOMMENDATIONS
9. ACKNOWLEDGMENTS (Optional)
10. APPENDIX (The Appendix may contain sketches, tables, and charts.)

AT ALL COMPETITIONS, THE MOUSETRAP CAR TECHNICAL REPORT WILL BE JUDGED ACCORDING TO THE TECHNICAL REPORT BREAKDOWN

MOUSETRAP CAR ENGINEERING DESIGN TECHNICAL REPORT BREAKDOWN

Content (1 – 36 pts)

Cover Page:

- a) Title (SECME: Mousetrap Car Technical Report)
- b) Names, addresses, and grades of team members
- c) School Name & Address
- d) School System/District
- e) School Coordinator's Name
- f) Date (date of competition)

Abstract:

- a) Includes the essential points of the purpose, methods, scope, results, conclusions, and recommendations
- b) Short—1 paragraph to 1 about 1 page in length (should be 10% or less of the total report)
- c) This is your chance to convince the readers that they should continue reading in a clear and concise way

Page of Contents:

Indicate on which pages the parts of the report can be located in a professional manner

Introduction:

Introduce the problem to be solved, your hypothesis, and how you planned to resolve the problem through design while dealing with any restrictions.

Design:

- a) Discuss the experimental process by which you altered your car.
- b) Reference the data tables from the appendix to defend the conclusions which cause you to change your design.

Construction Procedure:

- a) List Materials
- b) Clearly describe the procedures that someone with little knowledge of your car would follow to recreate it.

Operation:

Explain the process by which the car is prepared in order for it to run. Be explicit about the steps taken.

Conclusion:

- a) State whether your hypothesis was defended or rejected and why.
- b) Discuss the results of your final design and why it is superior to prior designs.
- c) Explain how future cars can further be improved and possibly a future hypothesis.

Acknowledgements: Optional

Appendix:

- a) Must include all data tables from experimentation
- b) Must include sketches of the car (top view, profile, and undercarriage view)
- c) May include a chart comparing the various trials

Mechanics (1 – 14 pts)

- 1) Correct punctuation, capitalization, and spelling
- 2) Use of past tense and passive voice
- 3) Sentences are complete with appropriate coordination and subordination
- 4) Report flows logically from one idea to the next with minimal fragmentation

Requirements

- 1) Required Components
 - a. Cover Page
 - b. Abstract
 - c. Contents
 - d. Introduction
 - e. Design
 - f. Construction Procedures
 - g. Operation
 - h. Conclusion
 - i. Appendix
- 2) Double-spaced Text
- 3) 1" borders on 8 ½ x 11 white paper
- 4) 12 pt. in Standard Font / Computer Typed
- 5) Report is neat and thorough and pages are numbered and in order

**SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR WRITTEN TECHNICAL REPORT
(Evaluation Sheet)**

Please Check: Middle School High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name			
		Date	
Regional/State Sponsor			

Requirements Check: Zero points for the Technical Report if the requirements are not met

- (1) Required Components (2) Double-spaced Text
- (3) 1" Borders on 8 ½ x 11 White paper (4) 12 pt./Standard Font / Computer Typed
- (5) Report is neat and thorough and pages are numbered and in order

CONTENT (0 – 36 points)	POINTS
i. Abstract (0 – 5 pts)	_____
ii. Page of Contents (0 – 2 pts)	_____
iii. Introduction (0 – 5 pts)	_____
iv. Design (0 – 9 pts)	_____
v. Construction Procedures (0 – 4 pts)	_____
vi. Operation (0 – 3 pts)	_____
vii. Conclusion (0 – 5 pts)	_____
viii. Appendix (0 – 3 pts)	_____

MECHANICS (0 – 14 points)	_____
i. Correct punctuation, capitalization, and spelling are evident throughout report	
ii. Correct use of past tense and passive voice	
iii. Sentences are complete with appropriate coordination and subordination	
iv. Report flows logically from one idea to the next with minimal fragmentation	

TOTAL (The highest possible score is 50) _____

Judge's Notes:

**SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR TEAM INTERVIEW WITH JUDGES**

As a part of the Engineering Design (Mousetrap Car) Competition, each student team will be interviewed by a panel of judges.

This 5-10 minute discussion will cover details of the car's design and testing as well as the Design Drawing and Technical Report.

TEAM INTERVIEW REQUIREMENTS AND GUIDELINES:

1. Team members are interviewed as a group.
2. Each member is expected to be able to serve as a spokesperson in response to questions from the judges.
3. The team interview will be conducted apart from the car run and scoring of its performance.
4. Interviews normally will take place after judges have received and scored the Design Drawing and Technical Report and completed the inspection and measurements (size, weight) that precede the car's run and scoring of its performance.
5. The team interview will be one element—along with Performance (car run), Design Drawing, and Technical Report—in arriving at the overall score in competition.

AT ALL COMPETITIONS, THE MOUSETRAP CAR TEAM INTERVIEW WILL BE JUDGED ON:

TEAMWORK
APPLICATION OF TECHNICAL PRINCIPLES
KNOWLEDGE OF DESIGN
ORAL COMMUNICATION SKILLS

**SECME ENGINEERING DESIGN COMPETITION GUIDELINES:
MOUSETRAP CAR TEAM INTERVIEW WITH JUDGES
(Evaluation Sheet)**

Please Check: Middle School High School

Team Name			
School Name			
District		State	
Student Name #1		Grade	
Student Name #2		Grade	
Student Name #3		Grade	
Judge's Name		Date	
Regional/State Sponsor			

Requirements Check: All three members present Each responds to questions
 Work is students' own True team effort is evident

EVALUATION CATEGORIES	POINTS
I. TEAMWORK All three members contributed with identifiable individual roles in final products and preparing car to run in competition. (1-10 points)	_____
II. APPLICATION OF TECHNICAL PRINCIPLES Team members analyzed requirements for car to perform and efficient means to transfer energy from spring to propel car (1-10 points)	_____
III. KNOWLEDGE OF DESIGN The design reflects knowledge of the formula used to judge performance and systematic efforts to maximize score (1-20 points)	_____
IV. ORAL COMMUNICATION SKILLS Team members each can speak clearly to the basis for their car's design and how that was applied in construction and testing. (1-10 points)	_____
TOTAL (The highest possible score is 50)	_____
TOTAL SCORE IN DRAWING CATEGORY	_____

Judge's Notes: