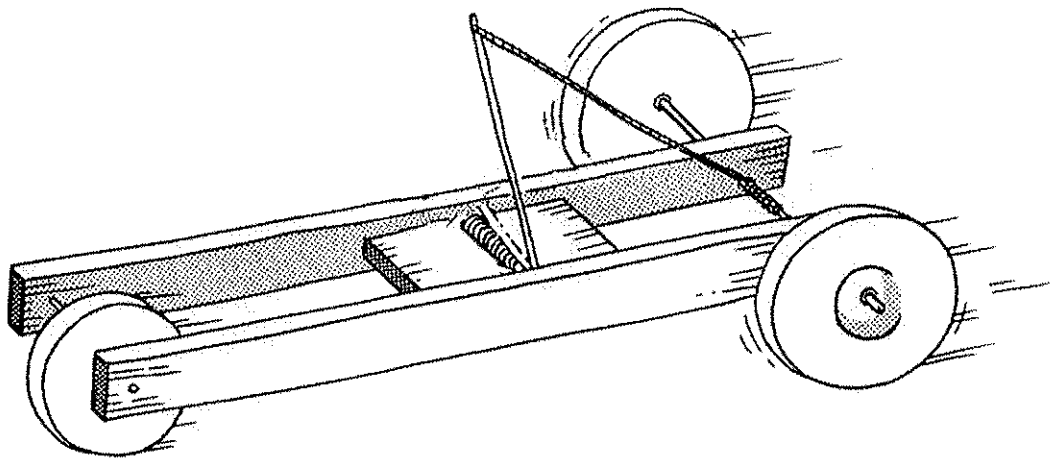


2013 SECME ENGINEERING DESIGN COMPETITION

MOUSETRAP CAR CONSTRUCTION AND OPERATION

Middle & High School Divisions



CONSTRUCTION REQUIREMENTS

(Any team not adhering to the construction guidelines will not be able to place)

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

1. Mousetrap Car Construction and Run
2. Technical Report on Mousetrap Car
3. Design Drawing of Mousetrap Car
4. Team Interview with Judges

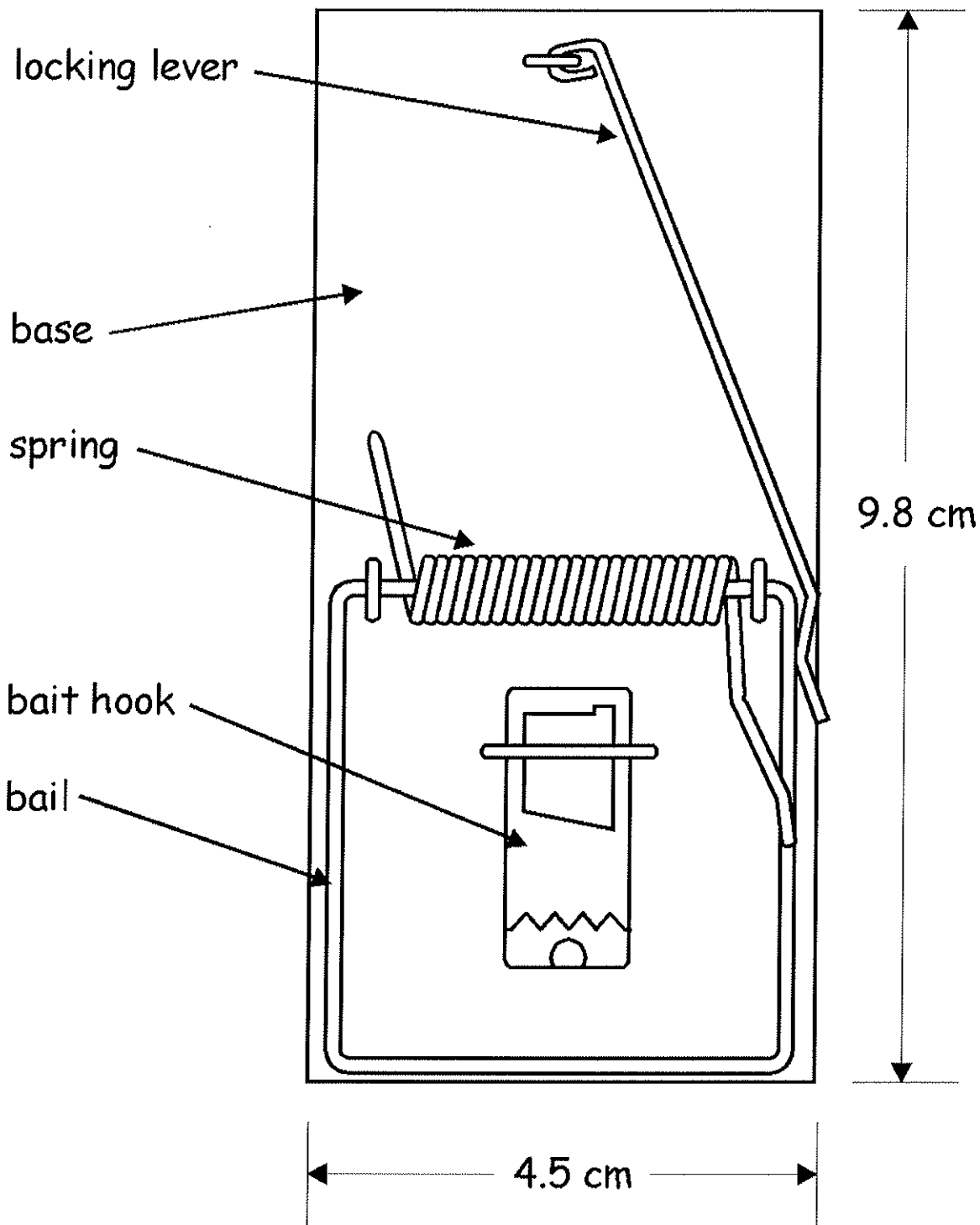
This is a **team competition** and should reflect the coordinated efforts of all members. **Three (3) students must be on each team.** **NOTE:** Consider alternate students that have worked with the team throughout the process to have replacements in the event an initial team member is not be available to travel to the national competition.

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: wooden 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 (with the staples that hold them on) 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 will be measured from the front of the front wheel(s) at the starting point to the front of the front wheel(s) at the stopping point of travel, utilizing a straight line to connect the two points.
8. There will be two runs for each car and the run with the highest performance score 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:

$$N = \left(\frac{w}{W}\right) * \left(\frac{D}{L}\right) + \frac{D}{T} \quad \text{and} \quad F = \frac{N}{N_L} * 100$$

where:

N = the performance run score.

w = average weight of a standard mousetrap measured in grams. (always 25g).

W = the total weight of the completed mousetrap car measured in grams.

D = Distance the car travels (measured in centimeters). The mousetrap car will be measured from the front of the front wheel(s) at the starting point to the front of the front wheel(s) at the stopping point of travel, utilizing a straight line to connect the two points. **UPDATE: There are NO MINIMUM OR MAXIMUM distances.** If the mousetrap car stops due to hitting an object or wall, the distance will be measured from the starting point to the point of impact.

L = the car's length measured in centimeters. The mousetrap car will be measured from the furthest point of the front of the car to the furthest point of the rear of the car while the car is at resting state and the spring unwound. **Please refer to MOUSETRAP CAR DRAWING EXAMPLE for more information on how to measure L.**

T = the total time the mousetrap car travels from the starting point to the stopping point measured in seconds.

N_L = the highest Performance score at the competition.

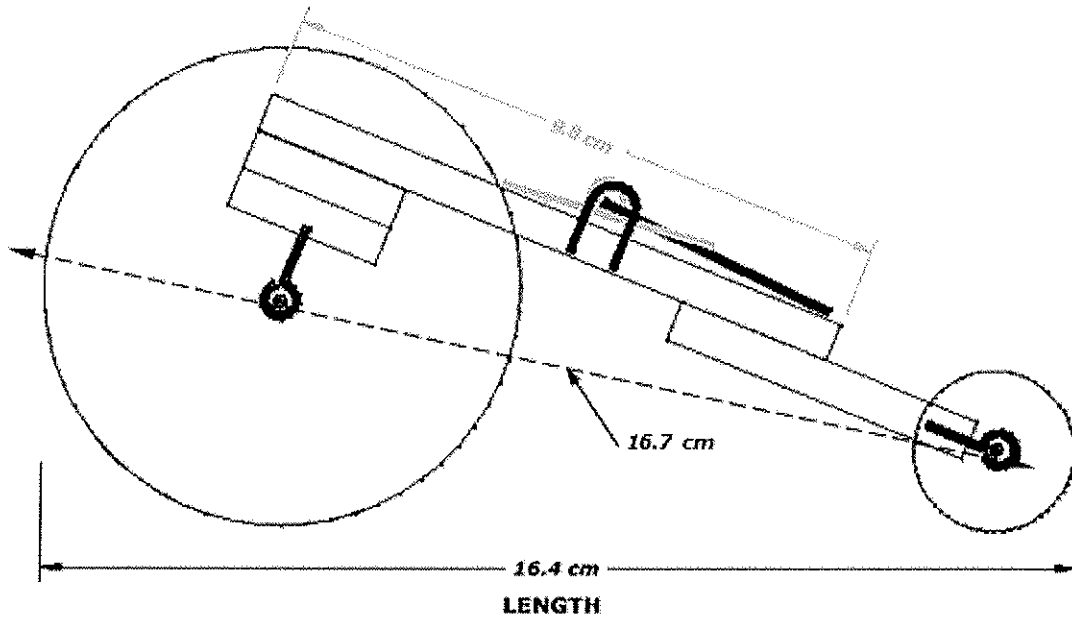
F = the final Performance score. **NOTE:** The final performance score will be combined with scores for the Technical Report, Design Drawing, and Team Interview.

*Judges will measure "L" (see illustration on following page) and "W" prior to the mousetrap car Performance runs. These measurements, together with "D" and "T" (determined by the car's run), are used to calculate "N" in the formula above.

Overall Team Score for the whole competition is sum of the following 4 categories (Max Total of 300 pts)

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

**Measurement of “L,” the Mousetrap Car’s Longest Dimension
(From the farthest point at the front of the car to farthest point at the rear of the car)**



“L” is the car’s length (measured in centimeters) from the farthest point at the front of the car to the farthest point at the rear of the car while the car is at a resting state and the spring unwound. If the bail has been straightened and protrudes past the front or rear of the car, the measurement will be taken from the end of the bail to the other end 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	
Time:	First Run	Second Run	

$$N = \left(\frac{w}{W}\right) * \left(\frac{D}{L}\right) + \frac{D}{T}$$

&

$$F = \frac{N}{N_L} * 100$$

w = [weight of standard mousetrap (always 25g)]

W = [Weight of completed car measured in grams]

L = [Length of car measured in centimeters]

T = [Time measured in seconds]

D = [Distance measured in centimeters]

N = [Performance score for that run]

N_L = [Highest Performance score at competition site]

Technical Report:	
Design Drawing:	
Interview:	
Best Performance Run (F):	
TOTAL:	

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

SECME ENGINEERING DESIGN COMPETITION REQUIREMENTS AND 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. **The drawing must be evaluated before the actual competition begins, normally during the competition registration. If the drawing is not evaluated before the competition begins the score will be zero.**

REQUIREMENTS:

There will be point deduction(s) for any entry not adhering to the requirements and guidelines.

1. The size of the engineering paper is required to be the standard 18" X 24" (see page 62 for online paper vendor)
2. The paper must be a plain, non-grid, 17-pound vellum sheet
3. There must be a 1" border on all sides
4. A *legend* is to be drawn in the bottom left corner of the drawing inside the 1" border

GUIDELINES:

1. **NO MOUNTING OR FRAMES ALLOWED BUT DRAWING MAY BE LAMINATED FOR PROTECTION IF DESIRED.**
2. 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.
3. 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).
4. All dimensions are required to be illustrated on the drawing.
5. The scale and the units are required to be indicated on the drawing.
6. The team's Mousetrap Car Drawing is required to show front, side, and top views.
7. All parts of the car are required to be labeled.
8. Ink pens, pencils or markers may be used.
9. A *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 DRAWING
(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: 18" x 24" Engineering Paper 1" Border (All Sides)
 17 pound Vellum Paper Title legend (on drawing)

***If requirement checks are NOT met:** There will be a five (5) point deduction per requirement not met. The total requirement deduction(s) will be deducted from the total technical drawing score. Maximum number of points for the Engineering Design Competition Mousetrap Car Drawing is 50. Please score each of the following four categories:

EVALUATION CATEGORIES

POINTS

- | | |
|--|---|
| <p>I. RESEMBLANCE: (0-15 points)
The accuracy to which the Mousetrap Car Drawing illustrates the actual Mousetrap Car designed and built by the team.</p> <p>II. SCALE : (0-15 points)
The proportions in the Drawing correctly relate to and represent the team's actual Mousetrap Car.</p> <p>III. NAMING/LABELING: (0-10 points)
The correctness of the names/labels of all of the parts in the Drawing of the Mousetrap Car.</p> <p>IV. APPEARANCE/NEATNESS: (0-10 points)
The quality of the visual presentation of the Mousetrap Car Drawing entry</p> | <p>_____ /15</p> <p>_____ /15</p> <p>_____ /10</p> <p>_____ /10</p> |
|--|---|

**Requirement check points deducted* - _____

TOTAL (The highest possible score is 50) /50

Judge's Notes:

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. 100 point maximum.

STRUCTURE: (Maximum points for Structure is 50 points)

NOTE: All 5 parts of the Structure are REQUIRED. Any component of the Structure not met will result in a zero score for Structure component of the technical report.

1. Cover Page: The technical report must include a cover page that is formatted as specified on page 15 of the guidelines.
2. The technical report must be double-spaced.
3. The technical report must be on 8½" x 11" white paper with 1" margins for top, bottom, and each side.
4. The technical report must be formatted with a 12pt standard legible text font (see acceptable fonts below).
5. The technical report pages must be numbered and in order.

GUIDELINES FOR CONTENT: (Maximum points for Content is 36 points)

1. COVER PAGE
2. TABLE OF CONTENTS
3. ABSTRACT
4. INTRODUCTION
5. DESIGN
6. CONSTRUCTION PROCEDURE
7. OPERATION OF MOUSETRAP CAR
8. CONCLUSION/RECOMMENDATIONS
9. ACKNOWLEDGMENTS (Optional)
10. APPENDIX

Main Body: These 4 Sections
Should Be a Maximum of 5 Pages

ACCEPTABLE FONTS:

Ariel	This is an example of Ariel font
Calibri	This is an example of Calibri font
Courier New	This is an example of Courier New font
Times New Roman	This is an example of Times New Roman font

MECHANICS: (Maximum points for mechanics is 14 points)

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

AT ALL COMPETITIONS, THE MOUSETRAP CAR TECHNICAL REPORT WILL BE JUDGED ACCORDING TO THE TECHNICAL REPORT BREAKDOWN (Continue to page 15 for breakdown)

MOUSETRAP CAR ENGINEERING DESIGN TECHNICAL REPORT BREAKDOWN

STRUCTURE (0 or 50 points)

1) Cover Page:

- a) Title (SECME: Mousetrap Car Technical Report)
- b) Name, grade, and complete home address of team members
- c) Team's school name & address
- d) School system/district name
- e) School coordinator's name
- f) Date (date of competition)

2) Double-Spaced

3) 8½"x11" white paper w/ 1" margins (all sides)

4) 12pt standard legible text font

5) Pages are numbered and in order

Content (0 – 36 pts)

Table of Contents:

- a) Indicate on which pages the parts of the report can be located in a professional manner
- b) Maximum one page

Abstract:

- a) Includes the essential points of the purpose, methods, scope, results, conclusions, and recommendations
- b) This is your chance to convince the readers that they should continue reading in a clear and concise way
- c) One-half to one page of technical report
- d) Should be 10% or less of the total report

Introduction:

- a) 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:

- a) 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 sketches of the car (top, profile, and undercarriage views)
- b) MUST include all data tables and/or charts from experimentation comparing the various trials

Mechanics (0 – 14 pts)

- 4) Correct punctuation, capitalization, and spelling
- 5) Use of past tense and passive voice
- 6) Report flows logically from one idea to the next with minimal fragmentation

**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			

- Structure check:** (1) Cover Page (2) Double-spaced Text
 (3) 8 1/2" x 11" White paper w/ 1" margins (4) 12 pt./Standard Font/Computer Typed
 (5) Report is neat and thorough; pages are numbered and in order

NOTE: All 5 parts of the Structure are **REQUIRED**. Any component of the Structure not met will result in a zero score for Structure component of the technical report.

STRUCTURE: (0 or 50 points) **POINTS**
_____ /50

CONTENT: (0 – 36 points)

Abstract (0 – 5 pts)	/5
Page of Contents (0 – 2 pts)	/2
Introduction (0 – 5 pts)	/5
Design (0 – 9 pts)	/9
Construction Procedures (0 – 4 pts)	/4
Operation (0 – 3 pts)	/3
Conclusion (0 – 5 pts)	/5
Appendix (0 – 3 pts)	/3

MECHANICS: (0 – 14 points)

Correct punctuation, capitalization, and spelling are evident throughout report (0-4 pts)	/4
Correct use of past tense and passive voice (0-3 pts)	/3
Report flows logically from one idea to the next with minimal fragmentation (0-7 pts)	/7

TOTAL (The highest possible score is 100) _____ /100

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. **NOTE:** Interview may take place before the scoring of the Design Drawing.
5. The team interview is a single element in determining each team's overall competition score. The other scores are derived from the Technical Report, Design Drawing, and Performance (car's best run).

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			

EVALUATION CATEGORIES

POINTS

- | | |
|--|------------------|
| <p>I. TEAMWORK (0-10 points)
All three members contributed with identifiable individual roles in final products and preparing their car to run in competition.</p> | <p>_____ /10</p> |
| <p>II. APPLICATION OF TECHNICAL PRINCIPLES (0-10 points)
Team members analyzed requirements for car to perform and efficient means to transfer energy from spring to propel car</p> | <p>_____ /10</p> |
| <p>III. KNOWLEDGE OF DESIGN (0-20 points)
The design reflects knowledge of the formula used to judge performance and systematic efforts to maximize score</p> | <p>_____ /20</p> |
| <p>IV. ORAL COMMUNICATION SKILLS (0-10 points)
Team members each can speak clearly to the basis for their car's design and how that was applied in construction and testing.</p> | <p>_____ /10</p> |
| <p>TOTAL (The highest possible score is 50)</p> | <p>_____ /50</p> |
| <p>TOTAL TEAM INTERVIEW SCORE (Average of all interviewers)</p> | <p>_____ /50</p> |

Judge's Notes: