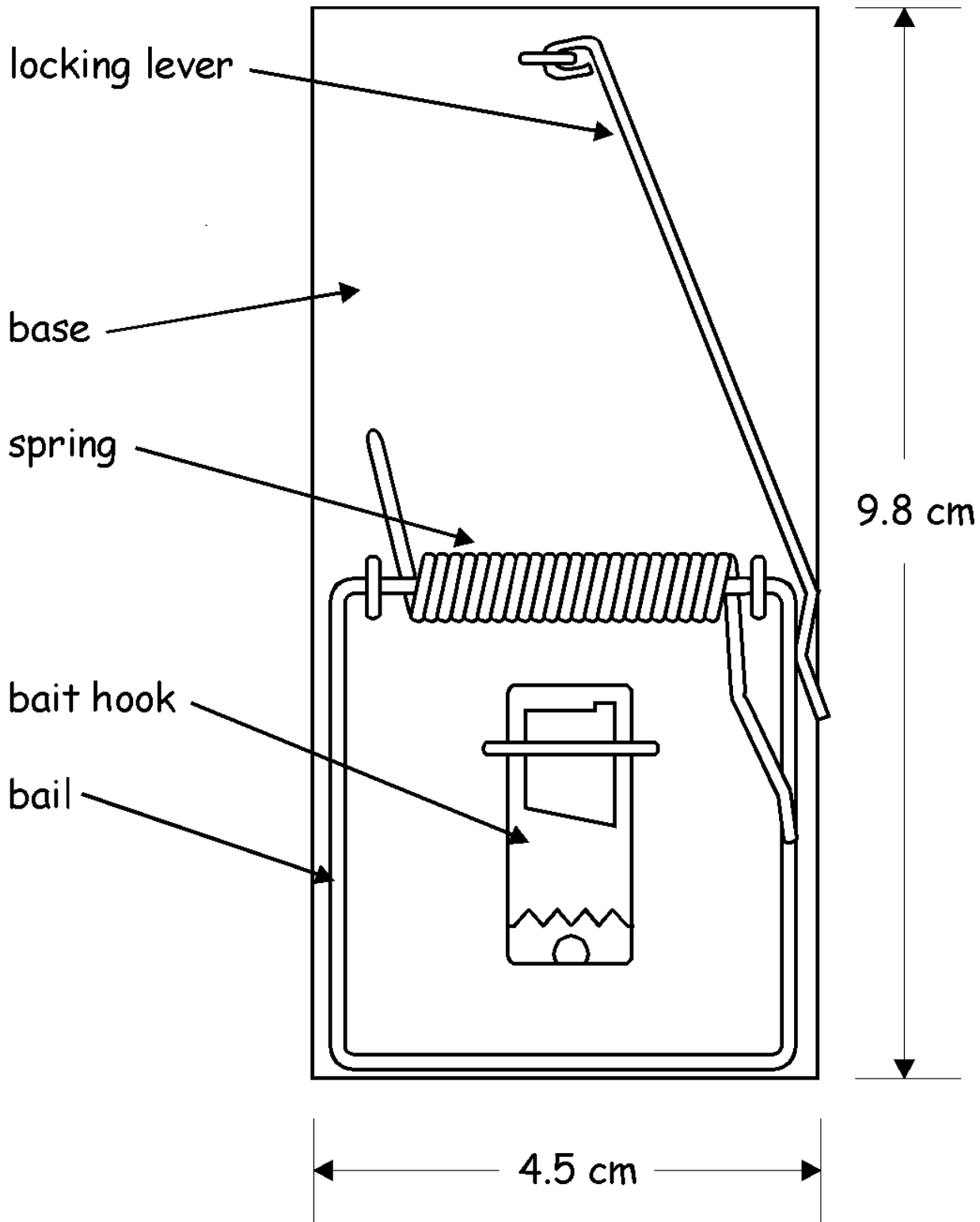


# GUIDELINES FOR SECME ENGINEERING DESIGN COMPETITION (MOUSETRAP CAR: CONSTRUCTION AND OPERATION)

## ENGINEERING DESIGN COMPETITION REQUIREMENTS:

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

1. The Engineering Design Competition **requires participation in these four areas:**
  - a. Mousetrap Car Construction and Run
  - b. Design Drawing of Mousetrap Car (***not required for elementary***)
  - c. Technical Report on Mousetrap Car
  - d. Team Interview with Judges
2. This is a **team competition** and should reflect the coordinated efforts of all members. **Three (3) students must be on each team.** Members must remain the same at all levels of competition (school, state/regional, and national finals).
4. Each team member is expected to be able to serve as a spokesperson and be fully involved with all aspects of the entry.
5. **A standard mousetrap**--usually about 4.5 X 10 centimeters and weighing about 25 grams—**must be used to build the car.**
6. 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).
7. The mousetrap spring must be the sole source of power. **(You may NOT use rubber bands, CO<sub>2</sub> boosters, or any other agent or element for extra power).**
8. **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.**
9. The spring must be visible and/or accessible to the judges for inspection.
10. The car must have a minimum of three wheels and can be made as long or short as desired as long as requirement #8 above is met.
11. Cars will be tested on a smooth flat surface. **Distance is measured from the starting line to the farthest point of travel, utilizing a straight line to connect the two points.**
12. **There will be two runs for each car; the better run will be used for final scoring of the mousetrap car's performance.**



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

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

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 in a straight line from the starting point to the stopping point 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.\*

N<sub>L</sub>...is the highest Performance score at the competition site.

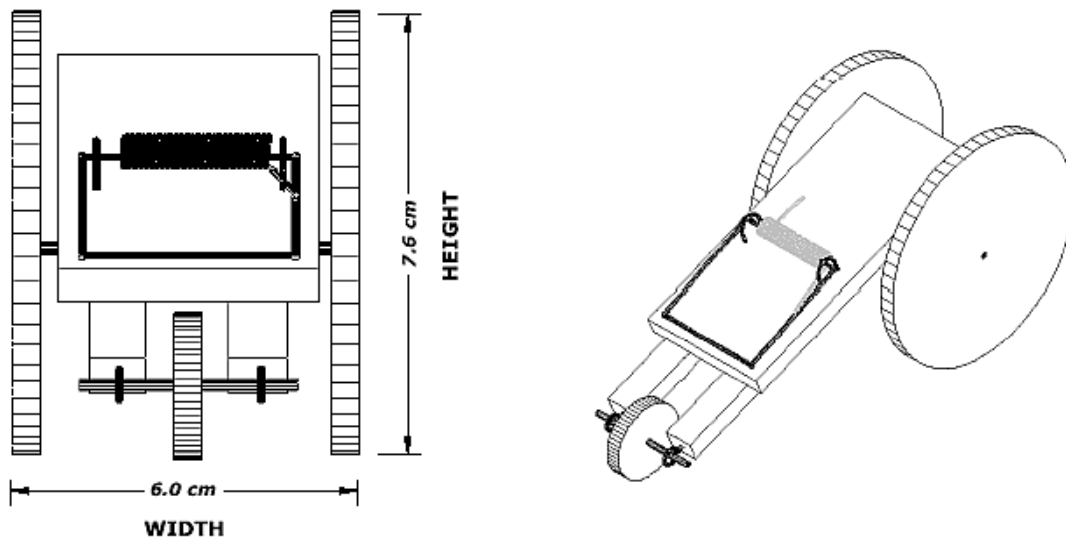
F....is the final Performance score (to be combined with scores for the Design Drawing, Technical Report, and Team Interview).

*\*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.*

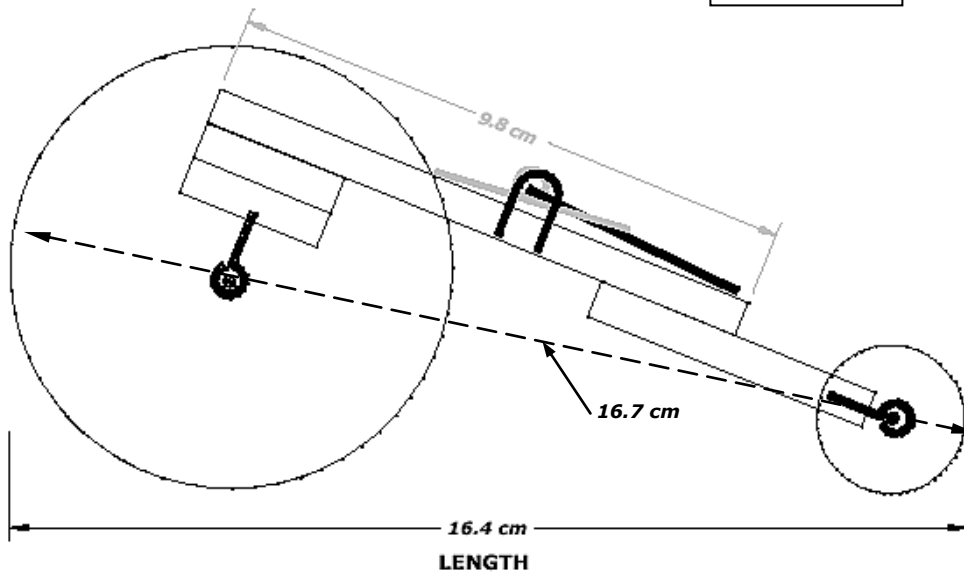
14. Overall Team Score in competition is sum of: 1) Performance (car run) as calculated above (max. 100 points); 2) Design Drawing (max. 50 points); 3) Technical Report (max. 50 points); and 4) Team Interview (max. 50 points). **Thus the maximum total is 250 points.**

15. See pages that follow for guidelines and evaluation sheets on each component of the Engineering Design (Mousetrap Car) Competition.

**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:  Elementary School       Middle School       High School

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

$$N = \left(\frac{w}{W}\right) \times \left(\frac{D}{L}\right)^2$$

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



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<sub>L</sub> =  [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 DRAWING  
(Evaluation Sheet)**

Please Check:     Elementary School             Middle School             High School

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

Requirements Check:     18" x 24" Engineering Paper     1" Border (All Sides)  
                                    17lb Vellum Paper                                    Title legend

**If requirement checks are NOT met:** Five (5) points from each of the 4 areas above will be deducted from the total score in this category. 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            The accuracy to which the Mousetrap Car Drawing illustrates the actual Mousetrap Car designed and built by the team. (1-15 points)</p>	_____
<p>II.       SCALE            The proportions in the Drawing correctly relate to and represent the team's actual Mousetrap Car. (1-15 points)</p>	_____
<p>III.      NAMING/LABELING            The correctness of the names/labels of all of the parts in the Drawing of the Mousetrap Car. (1-10 points)</p>	_____
<p>IV.      APPEARANCE/NEATNESS            The quality of the visual presentation of the Mousetrap Car Drawing entry (1-10 points)</p>	_____
<p>TOTAL (The highest possible score is 50)</p>	_____
<p><i>Requirement check points deducted</i></p>	_____
<p><b>TOTAL SCORE IN DRAWING CATEGORY</b></p>	_____

## 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 of the Technical Report
  - b. Name, addresses, grades of team members
  - c. Team's school name and address
  - d. School System name
  - e. School Coordinator's name
  - f. Date
2. ABSTRACT One-half to one-page summary of Technical Report.
3. CONTENTS One page
4. INTRODUCTION
5. DESIGN
6. CONSTRUCTION PROCEDURE
7. OPERATION OF THE MOUSETRAP CAR
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 ON:**

OUTLINE  
ORGANIZATION  
PRECISION  
SENTENCE FORMATION  
MECHANICS

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

Please Check:  Elementary School  Middle School  High School

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

Requirements Check:  Cover page with required information  12 pt. Type/Standard Font  
 Double-spaced Text  1" Borders  White paper

**If requirement checks are NOT met:** Five (5) points from each of the 5 areas above will be deducted from the total score in this category. The maximum number of points for the Engineering Design Competition Mousetrap Car Technical Report is 50. Please score each of the following five categories:

EVALUATION CATEGORIES	POINTS
I. <b>OUTLINE</b> Structure of Technical Report is complete, correct, and consistent with guidelines. (1-10 points)	_____
II. <b>ORGANIZATION</b> Technical Report follows a logical written description from design to final product. (1-10 points)	_____
III. <b>PRECISION</b> Procedures and steps followed are explained with clarity and exactness (1-10 points)	_____
IV. <b>SENTENCE FORMATION</b> Sentences are complete with appropriate coordination and subordination. (1-10 points)	_____
V. <b>MECHANICS</b> Correct punctuation, capitalization, and spelling are evident throughout report (1-10 points)	_____
TOTAL (The highest possible score is 50)	_____
<i>Requirement check points deducted</i>	_____
<b>TOTAL SCORE IN DRAWING CATEGORY</b>	_____

## **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:     Elementary School             Middle School             High School

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

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

**If requirement checks are NOT met:** Five (5) points from each of the 4 areas above will be deducted from the total score in this category. The maximum number of points for the Mousetrap Car Team Interview with Judges is 50. Please score each of the following four categories:

EVALUATION CATEGORIES	POINTS
I. <b>TEAMWORK</b> All three members contributed with identifiable individual roles in final products and preparing car to run in competition. (1-10 points)	_____
II. <b>APPLICATION OF TECHNICAL PRINCIPLES</b> Team members analyzed requirements for car to perform and efficient means to transfer energy from spring to propel car (1-10 points)	_____
III. <b>KNOWLEDGE OF DESIGN</b> The design reflects knowledge of the formula used to judge performance and systematic efforts to maximize score (1-20 points)	_____
IV. <b>ORAL COMMUNICATION SKILLS</b> 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)	_____
<i>Requirement check points deducted</i>	_____
<b>TOTAL SCORE IN DRAWING CATEGORY</b>	_____