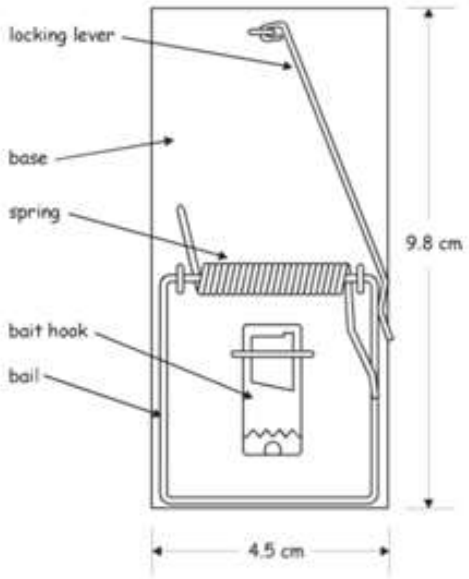
Mousetrap Cars
a design challenge exploring motion and forces and energy

Central Question: Can you build a mousetrap car that can travel five meters the fastest?

Three competitions: distance traveled, fastest, top performance score

Knowledge Probe: (15 points)

How do I build a mousetrap car?
What is energy?
How is energy stored in a mousetrap?
What is friction and how does it affect a car?
What makes a mousetrap car move?



Rules:

1. A standard mousetrap – about 4.5 x 10 cm 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 Figure 1).
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 for inspection.
6. The car must have a minimum of three wheels and can be made as long or short as desired.
7. There will be two runs for each car; the best score will be used for placement of teams.
8. For distance travelled, 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.
9. For fastest car, the velocity will be calculated on a pre-marked "track" 5 meters long.
10. For the top-performance score: (5 points for calculation)

$$P = \left(\frac{w}{W}\right) * \left(\frac{D}{L}\right) + \frac{D}{T} * (2)$$

P = performance run score

w = average weight of standard mousetrap (25 g)

W = total weight of completed mousetrap car (in grams)

D = distance car travels (in centimeters)

L = the car's longest measurement alone one of the three basic dimensions – length, width, height (in centimeters) measured with the bail extended or retracted, whichever is greater.

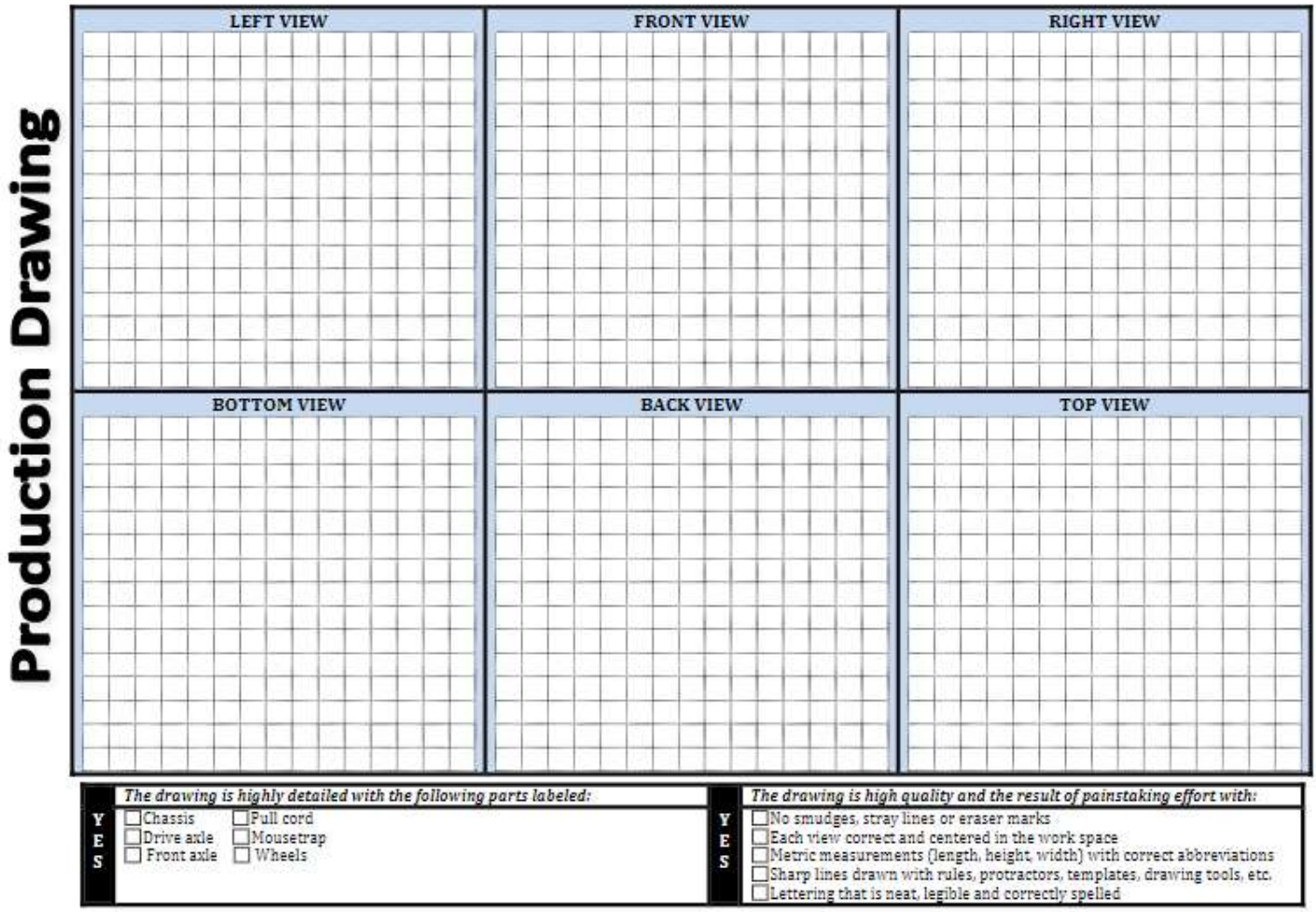
T = total time mousetrap car travels (in seconds)

Investigative Plan: (10 points)

Write out your investigative plan so another student can follow the directions and make a reasonable copy. Include scaled drawings once car is finished. Drawings must be of the actual mousetrap car built by team; photographs and computer generated drawings will NOT be allowed.

- All dimensions are illustrated on the drawing. (5 points)
- The scale and units are indicated on the drawing. (2 points)
- The team's mousetrap car drawing shows front, side, and top views. (6 points)

- All parts of the car are labeled. (5 points)
- Ink pens, pencils or markers may be used.



Observations: (5 points)
Create a data table to record your observations of how your car moves. Remember to record both quantitative and qualitative observations.

Data Analysis: (10 points)

1. Identify and interpret observations.
2. Determine what data are significant.
3. Identify patterns and trends that will help explain the data.

Evaluation: (20 points)

1. Analyze the car's motion:
   a. How far did your car travel horizontally?
   b. How long did your car take to travel this far?
   c. What was your car's average velocity?
   d. When did your car experience the highest acceleration? Lowest acceleration?
2. How did your group maximize the work done by the mousetrap spring on your car?
3. What role did friction play in the performance of your car? Did it aid or hinder the movement of the car?
4. Beginning with the stored mechanical energy in the spring, explain the multiple transformations the energy goes through as the car goes from being stationary to moving to stationary.
5. How did undertaking this project improve your understanding of work and energy?
6. How did you feel about this project when it was first assigned? Now that it's concluded?
7. What would you have done differently as you and your team worked through this project?