Mousetrap Car

Name _____

Teacher _____

Period _____

Purpose - To construct a vehicle that travels the greatest distance along a track of fixed width using a standard mousetrap as its only means of propulsion. The minimum distance requirement is 3 meters.

Mousetrap Car Record - 57.5 meters (188.7 feet)

ATTENTION PARENTS AND STUDENTS

The mousetrap car project requires the fabrication of a vehicle that may require the use of hand or power **tools**. Common tools used are scissors, knife, electric drill and handsaw or power saw. Follow all manufacture safety guidelines and directions including the use of safety goggles. Tools should be used under adult supervision.

The mousetrap car project requires the fabrication of a vehicle that may require the use of **adhesives**. Follow all manufacture safety guidelines and directions including the use of gloves and a well-ventilated work area. Adhesives should be used under adult supervision.

ALL WORK MUST BE COMPLETED IN CLASS.

Requirements

1. All work is to be completed in class. Cars that are built outside of class are not allowed. Cars will be stored in class and may not be taken home.

2. The car MUST be constructed using a STANDARD MOUSETRAP. Approximate dimensions are 10 cm X 4.5 cm. (See example mouse trap in class.)
   - The spring on the mousetrap may NOT be altered.
   - The arm of the mousetrap can not have a throw greater than 180 degrees (half a circle).
   - The mousetrap must be part of the vehicle and move with the vehicle

3. The vehicle must have:
   4 wheels for Regulars and
   3 wheels for PreAP.
   - A wheel is defined as any object that can rotate about an axis and makes contact with the floor at all times.
   - No more than two wheels per axle.

4. The ONLY means of propulsion is the potential energy stored in the mousetrap's spring and arm extension.
   - No other means of locomotive power are legal. Rubber bands, elastic, CO_2 boosters, etc. are not legal.
   - The propulsion of the vehicle must be a direct result of Newton's Third Law of Motion between the floor and the wheel(s) of the car. In other words, no part of the vehicle may push (or pull) off any surface other than the floor beneath the car.
   - No secondary propulsion system may be engaged as a result of the vehicle's operation and in turn aid in the propulsion of the vehicle

5. WOOD – Can you build with wood?

PERMITTED	DISALLOWED
round wood dowels	dimensional lumber
square wood dowels	plywood
popsicle sticks	particleboard
wood rulers	OSB
wood paint sticks	BALSA WOOD
	BASSWOOD
	thin sheets of wood

6. DISALLOWED MATERIALS:
   - Legos
   - K'nex (wheels, sticks, bricks, gears, etc.)
   - pre-fabricated wheel bearings, wheels with bearings, any toy or toy part that has bearings; NO bearings of any kind.
   - pre-fabricated vehicles, purchased or a kit.
   - WOOD – See above.
   - Teacher may disallow additional materials.

7. The vehicle must be fully autonomous after if leaves the start line.

8. Failure to meet these specifications will result in disqualification and a grade of zero.

IT IS THE STUDENT'S REPSONSIBLITY TO HAVE ANY QUESTIONABLE MATERIALS APPROVED BY HIS OR HER TEACHER PRIOR TO CONSTRUCTION.

Helpful Hints — Search the Internet.

Car Testing

1. The vehicle will be tested on a smooth flat surface 1.83 meters (6 feet) in width.

2. The distance traveled will be measured along the center-line of the track.

3. Any vehicle that exits the track before coming to a complete stop will have its exit point marked and the distance traveled measured from the starting line along the center-line to the adjacent exit point.

4. Each vehicle will complete two runs. The better of the two runs will be recorded.

5. The distance traveled will determine the final grade. Refer to the score card for details.

6. **ALL** vehicles will be **DESTROYED** after testing (the completion of the two runs).

Mousetrap Car Score Card

Name _____

Name _____

Name _____

Three or Less per Group

Teacher _____

Period _____

Run	Distance	Grade
1st		
2nd		

Final Grade

	Run Distance	Grade
Beyond Minimum Distance	20 meters	100
	19 meters	99
	18 meters	98
	17 meters	97
	16 meters	96
	15 meters	95
	14 meters	94
	13 meters	93
	12 meters	92
	11 meters	91
	10 meters	90
	9 meters	89
	8 meters	88
	7 meters	87
	6 meters	86
	5 meters	85
	4 meters	84
	3 meters	83
	2 meters	82
	1 meter	81
	Distance = Minimum (minimum = 3 meters)	80
	Distance < 3 m	65
	*Rolling Chassis	50
	**Disallowed Cars	<50

Design, Construction and Performance Notes

*A rolling chassis that meets all design requirements (excluding mousetrap) and rolls 3 meters with a reasonable push earns a 50.

**Cars that do not meet design requirements are scaled between 0 and 50. A car that travels 20 meters beyond minimum earns a 50; a car that travels minimum earns a 40; a car that travels less than minimum earns a 35; a rolling chassis or car the needs assistance starting earns a 25.

Bonus Points

One bonus point will be awarded for every 2 meters traveled in excess of 20 meters beyond minimum. Bonus points are awarded ONLY to vehicles that meet all specifications.

Mousetrap Car

Pre-Build Questions - Rules

Name _____

Teacher _____

Period _____

Go to http://www.GravityKills.net for mousetrap car directions and course calendar to answer the questions below.

1. How many members are allowed per building team? May you work alone?

2. Where are you allowed to construct your car?

3. Where are you NOT allowed to construct your car?

4. Are you allowed to design your car outside of class?

5. Where will your car be stored?

6. Describe the type and size of mousetrap you're allowed to use.

7. Can the mousetrap be altered?

8. How many wheels must your car have?

9. How many wheels are allowed on an axle?

10. What is permitted to provide your car's propulsion?

11. What is NOT permitted to provide your car's propulsion?

12. What materials are allowed in the construction of your car?

13. What materials are NOT allowed in the construction of your car?

14. What does "fully autonomous" mean?

15. How far must your car travel to get a passing grade?

16. What grade do you want to earn on this project? How far must your car travel to earn this grade?

17. How is the distance your car traveled measured?

18. How many attempts do you get to run your car for a grade?

19. When will testing of the cars begin? When will testing of the cars end?

20. What will happen to your car after its final testing?

Mousetrap Car
Pre-Build Questions - Design

Name _____

Teacher _____

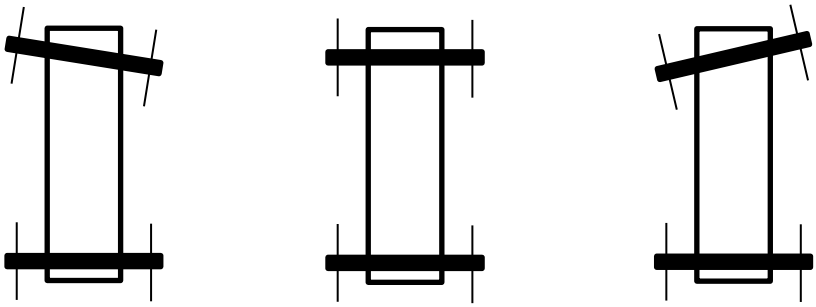
Period _____

Biggest Obstacle

What's the biggest problem you will have to address when designing and building your car? HINT – one word.

Alignment

Which way will each car travel?



How should the "fixed" axials be aligned for the car to roll in a straight line?

Difficulty Challenge – Make an adjustable axial – steerability.

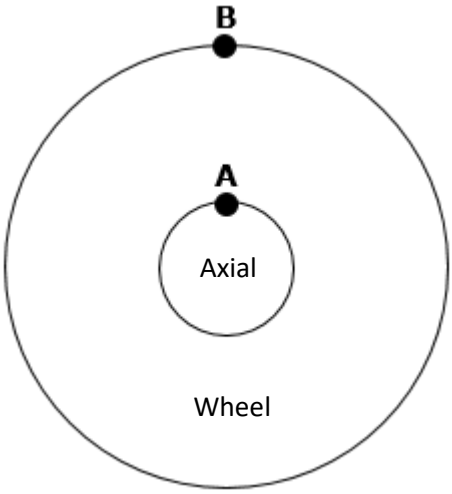
Mousetrap

Potential energy is transferred from the spring in the mousetrap to kinetic energy of the car. It will be necessary to extend the arm of the mousetrap in order allow for the transfer of energy.

How does the potential energy stored in each mousetrap with arm compare?

Which mousetrap with arm exerts the greatest force at the end of the arm?

It will be necessary to wrap string around the axial of the car.



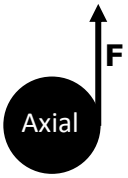
Rotation

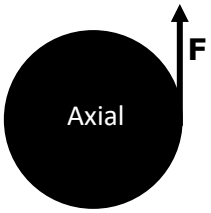
Allow point A to rotate once. How far will point B travel?

Allow point B to rotate once. How far will point A travel?

Torque

Assuming the same force, which axial is easier to turn?





What are the pros and cons of axial diameter and force combinations?

Consider the ease/difficulty to rotate the axial, length of mousetrap arm, length of string wrapped around the axial and the biggest obstacle to overcome while building your car.

Axial Diameter	Force	Pros	Cons
Large axial	Large Force		
Large axial	Small Force		
Small Axial	Large Force		
Small Axial	Small Force		

Design Sketch – Sketch your car (side view). Let each square equal 1 inch.

Mousetrap Car
TEKS/Objectives

Introduction TEKS

(1) Physics. In Physics, students conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include: laws of motion; changes within physical systems and conservation of energy and momentum; forces; thermodynamics; characteristics and behavior of waves; and atomic, nuclear, and quantum physics. Students who successfully complete Physics will acquire factual knowledge within a conceptual framework, practice experimental design and interpretation, work collaboratively with colleagues, and develop critical thinking skills.

Knowledge and Skills TEKS

(1) Scientific processes. The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:
  (A) demonstrate safe practices during laboratory and field investigations; and
  (B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(2) Scientific processes. The student uses a systematic approach to answer scientific laboratory and field investigative questions. The student is expected to:
  (E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, ~~and evaluating numerical answers for reasonableness~~;
  (K) communicate valid conclusions supported by the data through various methods such ~~as lab reports, labeled drawings, graphic organizers, journals, summaries~~, oral reports, ~~and technology-based reports; and~~

(3) Scientific processes. The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to
  (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
  (E) research and describe the connections between physics and future careers; and

(4) Science concepts. The student knows and applies the laws governing motion in a variety of situations. The student is expected to:
  (B) describe and analyze motion in one dimension ~~using equations~~ with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, and acceleration;
  (D) ~~calculate the effect of forces on objects~~, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects;

(6) Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:
  (B) investigate examples of kinetic and potential energy and their transformations;
  (D) demonstrate and apply the laws of conservation of energy ~~and conservation of momentum~~ in one dimension;
  (G) analyze and explain everyday examples that illustrate ~~the laws of thermodynamics~~, including the law of conservation of energy ~~and the law of entropy~~.