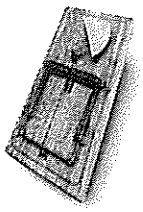
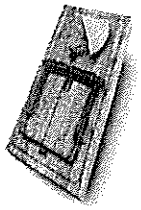


Mouse Trap Car Activity



OBJECTIVE:

Build a vehicle powered solely by the energy of one standard-sized mouse trap that will travel the greatest linear distance.

By definition, a vehicle is "a device with wheels or runners used to carry something (e.g., car, bus, bicycle, or sled.)"

REGULATIONS:

1. The device must be powered by a single mouse trap (1 ¾" X 3 7/8").
2. The device cannot have any additional potential or kinetic energy at the start other than what can be stored in the mouse-trap's spring itself. (This also means that you cannot push or start your vehicle.)
3. The spring from the mouse trap cannot be altered or heat treated.
4. The spring cannot be wound more than its normal travel distance.
5. Vehicles must be self-starting. Vehicles may not receive a push in the forward direction or side direction.
6. The vehicle must steer itself.
7. Distance will be measured from the front of the tape at the starting line to the point of the vehicle that is furthest away from the start line.
8. The teacher has the final decision as to the appropriateness of any additional items that might be used in the construction of the vehicle.

RUNNING THE CONTEST:

1. The race track can be any smooth level floor; we will use the non-carpeted hallway.
2. Each contestant will be given three attempts. The winner will be the vehicle which has obtained the greatest distance on any one of the three attempts. Any ties will be decided by a single run-off between the vehicles which tied.

WHAT IS A MOUSE-TRAP CAR AND HOW DOES IT WORK?

A mouse-trap car is a vehicle that is powered by the energy that can be stored in a wound up mouse-trap spring. The most basic design is as follows: a string is attached to a mouse-trap's lever arm and then the string is wound around a drive axle causing the mouse-trap's spring to be under tension. Once the mouse-trap's arm is released, the tension of the mouse-trap's arm pulls

the string off the drive axle causing the drive axle and the wheels to rotate, propelling the vehicle. In order to make your vehicle travel a great distance you will need to understand certain concepts.

KEY TERMS:

MOTION: Today we describe motion as rates of change or some quantity divided by time.

FRICTION: Friction is a force that always opposes motion in a direction that is opposite to the motion of the object. There are two kinds of friction, surface friction and fluid friction. Surface friction occurs anytime two surfaces slip, slide, or move against one another. Fluid friction, also known as air resistance occurs when air affects the object in motion.

INERTIA: Inertia is resistance to change.

FORCE: Force is a push or a pull. This is Newton's Third Law of Motion, which is whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. For example when you push on a wall, the wall pushes back on you!

ACCELERATION: Acceleration is a change in velocity. Acceleration is something you can feel, when you step on the gas pedal or break pedal in a car you feel yourself accelerate or decelerate.

MOMENTUM: Momentum is inertia in motion. More massive vehicles will tend to maintain their motion, coasting farther than a lighter vehicle given the same force. The downside to having a heavier vehicle is that it takes more energy to start moving the vehicle.

CENTER OF MASS: Is simply the average position of all particles of mass that make up an object.

ROTATIONAL INERTIA: The property of an object to resist changes in its rotational state of motion is called rotational inertia.

ENERGY: Energy is the ability to do work.

TORQUE: Exerting a turning force on an object is called torque.

BUILDING THE PERFECT DISTANCE CAR

LONGER LEVER ARMS:

The more string that can be pulled off the drive axle the more turns the wheels can make. This causes your vehicle to cover more distance under the pulling force.

SMALL DRIVE AXLE:

You can get more turns with a smaller axle for the same length of string than with a larger one. More turns of the axle means more turns of the wheel, which means greater travel distance.

SMALL POWER OUTPUT:

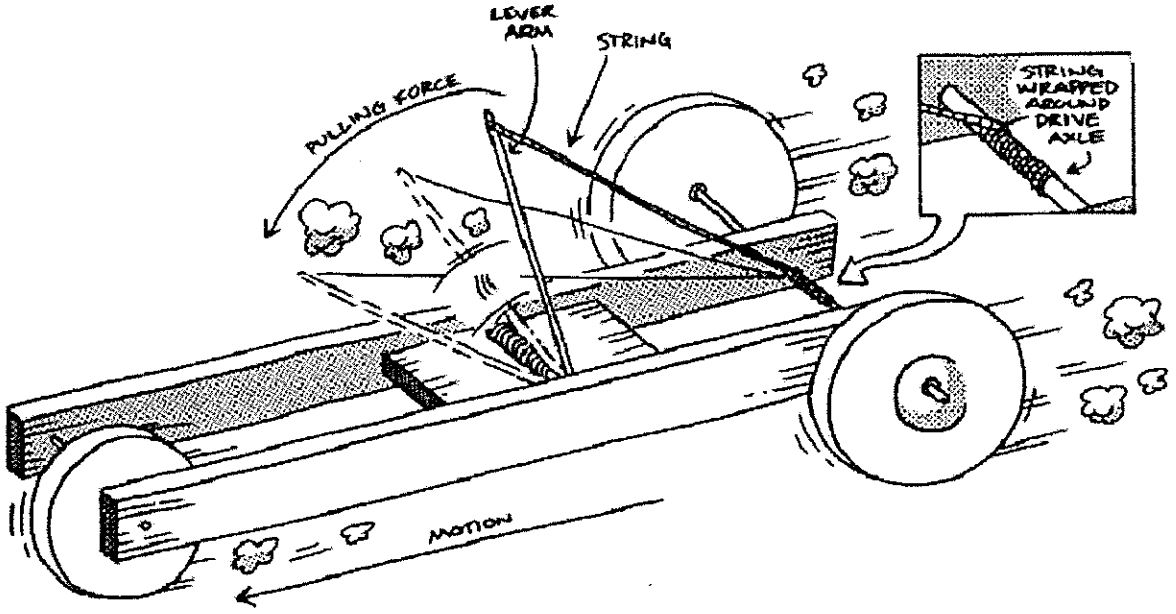
Vehicles that move slower tend to be more energy efficient in comparison to an equally built car of same rolling friction. You can slow a car down by increasing the lever arm length and repositioning the mousetrap further from the drive axle. At low speeds, air resistance is not a large factor in the motion of a moving object, but as the speed of an object increases, the force of air resistance also increases: therefore, at higher speeds moving objects will have to expend more energy to maintain constant velocity. For this reason, it is best to build a slow moving distance car!

DECREASE MASS AND ROTATIONAL INERTIA:

Build a lightweight frame and use lightweight wheels. Remove mass from wheels to decrease rotational inertia.

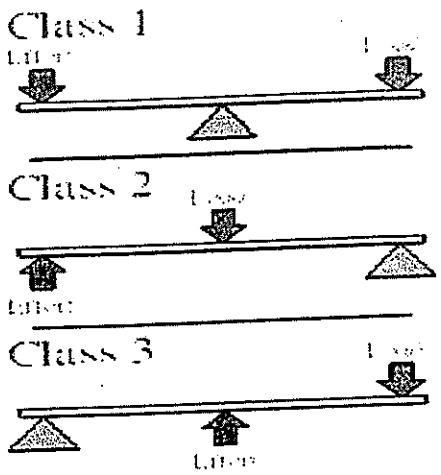
REMOVE FRICTION:

This one is impossible but the more you can reduce friction, the less energy that will be lost to heat and sound which translates into greater travel distance. Your vehicle should have the lowest possible energy consumption; this means that your vehicle should be a slow mover and use ball bearings.

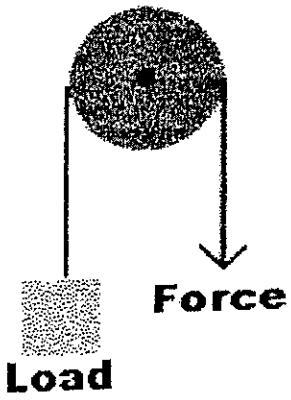


Use the internet to research methods of completing the land transportation assignment. While using the internet possible search items could include, but are not limited to:

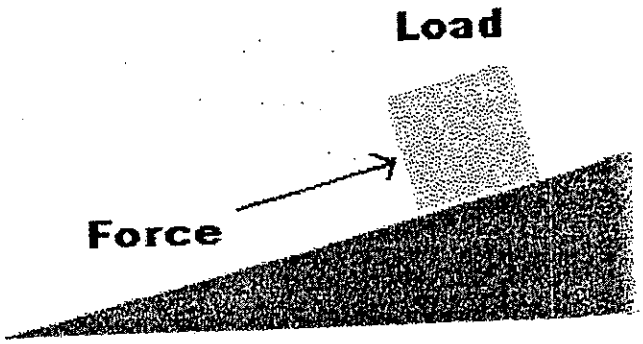
- Mouse Trap Car
- Pulley and belt
- Levers
- Force
- Wedge
- Lever
- Wheel and Axle
- Inclined Plane
- Screw



Lever



Pulley



Incline

Use the information gathered from your research to brainstorm a list of possible solutions. Submit these ideas to your instructor so that they can help you with your brainstorming effort. From this list, select the option in which you think will best complete the assignment. Submit your final drawings to the instructor for approval so you can start construction of your vehicle.

Brainstorming

Name: _____

Directions: Sketch 3-5 different mouse-trap designs for your vehicle. Show creativity and some detail.

Final Design

Name: _____

Directions: Draw (1) mouse-trap car design for the vehicle you are going to build. You must have a top view, side view, and bottom view. Show creativity and more details.

Mouse Trap Car Activity

Data Collection Sheet

Name: _____ Period: _____

1. What was the total distance your mouse trap car traveled?

Attempt:	Distance Traveled:
1	
2	
3	

3. What designs did your mouse trap car have to allow it to travel a long distance?

4. How could you have improved your vehicles design to travel a longer distance?

Mouse Trap Car Activity

Evaluation Sheet

Name: _____

1. Brainstorming (10 pts. Possible)

0 – 1 example	0
2 – 4 examples	5
5 – Up examples	10
Total	_____/10

2. Final Design (10 pts. Possible)

Little evidence of detail	0
Moderate evidence of detail	5
Strong evidence of detail	10
Total	_____/10

3. Fabrication of Mouse-Trap Car (50 pts. Possible)

Poor Fabrication	0
Moderate Fabrication	25
Excellent Fabrication	50
Total	_____/50

4. Lab Behavior and Effort (15 pts. Possible)

Showed no effort, did not follow directions or criteria	0
Showed effort, followed some directions	10
Showed effort, followed all directions	15
Total	_____/15

5. Distance Traveled (15 pts. Possible)

0 to 5 feet	2
5 to 10 feet	5
10 to 15 feet	8
15 to 20 feet	11
Over 20 feet	15
Total	_____/15