LAB: MOUSE TRAP CARS

Name: Period:
Partner:

INTRO

In this unit we will be reflecing on Newton and his laws of motion. Each law of motion, while distinct, involves forces and its subsequent effect on motion. In this lab, we will be constructing a "car" that is powered simply by the force exerted by the mousetrap spring. Mousetraps usually store **one joule** of energy (which is lethal to a mouse).
Everyone will start with the same mouse traps (Victor brand) and will only be allowed the use of one trap for their car's construction. This is a very **inquiry** based experiment (i.e.-you will have to *think* and *research* for this one!!) **Good luck!**

PURPOSE

How will we build cars that are powered from the stored energy in a mousetrap's spring that can travel long distances (at least 5m) in a short amount of time and/or be creative in design?

PRELAB QUESTIONS

1. Brainstorming (get approval before moving on to the next question)

Parts of Car	Possible Materials	Affect on Motion
Body		
Wheels		
Axles		
Lever Arm		
String		
Other/Miscellaneous		

Teacher's OK:_____

Detailed sketch of proposed design

It is important to have an idea of what your car will look like and how it will operate **before** *you start building it. You may have to modify the design slightly as you work out the "quirks", but you have to have a starting point.*

Teacher's OK to move forward:_____

Shopping/finding list

Your shopping/finding list does not need to be long, nor does it need to cost a lot to build a great mousetrap car. You can probably find most items at home in an old toy bin. What you can't find, you should be able to purchase from most home hardware stores inexpensively.

Provided for each group	• Mousetrap • One set of wheels with axle and straw to hold it. • Base • Two rubber bands to hold the trap to the base. • Tape (a few options) • String (a few options)

Lab Partner	Needed Material	Store to Buy From/Bring from Home

NOTE: You may ***not*** buy/use a mousetrap car kit!!! Cars designed from prepackaged kits will be disqualified from the lab.

MATERIALS ARE DUE BY:Thursday, February 27th.

Teacher's OK:_____

HELPFUL RESOURCES:

- **Docfizzix:** (Remember don't buy the kits!!) http://www.docfizzix.com/
- If you are having specific trouble with your car, Doc Fizzix can help you fix it! http://www.docfizzix.com/help.htm
- **The Best in Mousetrap Cars** http://home.flash.net/~funtraps/carts.htm
- **A link to Lots of Other Mousetrap Car Links!** http://www.hypography.com/topics/mousetrapcar.cfm
- **Mousetrap Cars** http://cpphysics.homestead.com/mousetrap.html
- **Mousetrap Cars Planner – includes pictures** http://www.mousetrap-cars.com/project-plans.htm
- **Construction Tips** http://www.mousetrap-cars.com/construction_tips.htm (there is an underscore between "construction" and "tips")
- **PBS Mousetrap Car** http://www.pbs.org/saf/1208/teaching/teaching.htm

Initial Testing Friday

- On Friday, we will do some initial testing of the speed of your car.
- From these test results, you will be able to go back and make adjustments to your design in order ot get better results.

ANALYSIS QUESTIONS

NEWTON'S 1ST LAW

2. Describe why Newton's First law is also called the Law of *Inertia*.

3. What property of matter is related to inertia? How could this information be applied to the selection of materials for your mousetrap car? Explain.

4. Draw a force diagram for your car *before* you let it go.

5. What type of motion is the car in at this phase? As a result, what would the net force be? Explain how you know this.

6. Draw a force diagram for your car *right after* you let it go (when the string is still pulling the back axle).

7. What type of motion is the car in at this phase? As a result, what would the net force be? Explain how you know this.

8. Would having a longer string and lever arm be beneficial or harmful to the motion of your car? Why? (*HINT*: What force(s) would be present *while* the string is pulling??)

9. Draw a force diagram for your car *after* the string has been pulled all the way around the axle (i.e.-the string has become detached).

10. What type of motion is the car in at this phase? As a result, what would the net force be? Explain how you know this.

11. How do the forces on the mousetrap car compare while the car is speeding up to when the car was first released?
    a. The forward force on the car is greater than friction.

b. The downward force on the car is balanced by the forward force.

c. The force from the mousetrap is balanced by the friction on the car.

d. The force of gravity is greater than the force up from the floor on the car.

12. Summarize your findings of this lab in relation to Newton's 1st law. Do you think this lab helped reinforce the concept of Newton's 1st law or no? Why?

NEWTON'S 2nd LAW

13. What is the definition of acceleration?

14. How does Newton's 2nd law relate the acceleration, mass, and force of an object? Write the equation below.

15. Using a spring scale, determine the amount of force, in newtons, the spring is providing for the car at each level of incline for the lever arm.

Angle (degrees)	**Force (N)**	**How to Measure Force with a Spring Scale**
45		
90		
135		
Average		

16. Measure and record the *mass* of your car in grams. Convert this number to kilograms.

17. Using Newton's second law equation (**a=F/m**) calculate the average acceleration of your car using the equation:

18. What force(s) caused the mousetrap car to eventually come to a stop?

NEWTON'S 3rd LAW

19. State Newton's 3rd law below.

20. What was the action force that was being applied to the back axle of your mousetrap cars?

21. What was the subsequent reaction force?

22. What do you know about the reaction force compared to the action force?

23. Do the action and reaction forces act upon the same object? How do you know?

24. Draw a force diagram of these action-reaction forces below.

25. Explain what would happen to the motion of your mousetrap car if you had wound the string around the back axle of the car *forwards* instead of *backwards*. Make sure you use Newton's 3rd law to quantify and qualify your response.

Final testing data

Table 1: Calculating Speed of Your Mousetrap Car

Trial #	Distance (m)	Time (s)	Average Speed (m/s)
1			
2			
3			
Average			

Table 2: Possible Bonus Points (Bonus CANNOT exceed 15 points per group)

	Longest Distance (m)	Fastest Speed (m/s)	Most Creative	Grand Total
Extra Credit Possible	**/5pts**	**/5pts**	**/5pts**	**/15pts**