Building a Mousetrap Racer or "Newton Scooter"

Names:

Purpose: A racecar which is powered by a mousetrap works by Newton's 3rd Law of Motion. To complete this activity, students apply their understanding of all 3 of Newton's Laws.

The Racer's Engine: The action force of the mousetrap spring snapping closed, if engineered correctly, causes a reaction force which makes the racer go.

Challenge: Can you build a mousetrap racer which will win a race? Give it a try!

Materials: mousetrap, straws, axles, thread, wheels, chassis (foam board), dowel (optional)

Procedure:

1. Working with a partner, obtain your materials and work together to build your car.
2. Design your car. You must make a cutout in your chassis at your rear or front axle to wind thread for the mousetrap to pull. Use a pen to mark cuts on your foam board for this. See class examples for ideas. You can cut your chassis to a custom shape. Be creative! See Mr. Morgan to have your cuts made.
3. Glue your mousetrap to your foam board using a hot glue gun. Be sure to glue your mousetrap so the wire "trap" is AWAY from your axle cut-out when not set.
4. Cut your straw axle bearings to length using scissors. Glue them to your foam board where you want your front and rear axles. The more carefully you do this, the straighter your racer will run.
5. Mark your axles to length, leaving 1 - 2 cm extra on each side for wheel attachment. See Mr. Morgan for cuts to your axels if needed.
6. Fit your axles through your bearings and onto your racer. When you are satisfied with how they fit, glue your wheels with a drop of hot glue before you push them into place.
7. Glue CDs to your wheels to make your car go faster and farther. Center them carefully when you glue them so that your car doesn't wobble.
8. Using about 30 cm of thread, tie one end to the mousetrap "trap" wire.
9. To prepare your racer to race, set the wire trap. Then, carefully wind the thread around the axle until it is tight by turning your axel/wheels backward. Try moistening the axel with a drop of water to help the thread stay put. The direction you wind the thread determines which way it will go (forward or backward).
10. Position your car on the floor, and using a ruler or pencil, set off your mousetrap.
11. After practicing with your car, race it against other cars!
12. <u>To consider:</u> Are there modifications you could make to give your racer a longer and faster run? Try extending the wire trap with a piece of dowel so that it pulls longer on your axel.
13. Once your car is working well, continue with the Analysis.

Analysis: <u>Estimate the force exerted by the spring "engine" of your car.</u>

1. Run your racer, timing how long it moves from start to stop (overall time).
2. Measure the distance.
3. Calculate average velocity. Use this for velocity final.
4. Run your car again, and time how long your car accelerates. When the wire fully extends and your car starts coasting, stop your timer. This is your acceleration time.
5. Calculate your cars acceleration.
6. Weigh your car.
7. Calculate the action force of the spring using Newton's Second Law.
8. Put your data in the data table on the back of this sheet or on your own paper.

* (w/ class data)

use science notebook
Notes to complete

Mousetrap Racer Data

#1 - Run Time 4.8 s *

#2 - Run Distance 7 m *

#3 - Velocity (V_f) _____ ↙ You Do

#4 - Acceleration Time _____ ↙ You Do

#5 - Acceleration _____ ↙ You Do

#6 - Car's Mass 87 g *

#7 - Action Force of the Spring _____ ↙ You Do