STEAM Mousetrap Car Project - GUIDED Research and Calculations Expectations

Contents:

Objective: To link science with the design of your Mousetrap car in a manner that will specifically help you maximize the design of your car.

Task:

1. Copy this document to your drive. Share it with your partner. Work together to read through the documents and answer questions and take notes as you go. You will each be responsible for the content and will need to include it in your final presentation. Make sure you both understand fully what you record together!

2. Read the given reading packet and answer the following questions fully, ***in your own words***.

PART I: What is a Mousetrap Car and How does it Work?

1) What is a mousetrap car?

2) What propels the mousetrap vehicle?

3) List at least 5 variables that affect the performance of a mouse-trap car (refer to the research you have done so far).

- **a)**
- **b)**
- **c)**
- **d)**
- **e)**

4) What will you learn by building a mousetrap car?

5) How is building a mousetrap car an advanced form of problem solving?

6) How will you determine how to implement the ideas and hints for building a mousetrap car offered in this packet?

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7) There are two sample challenges described in the packet ("How Far Can you Go?" and "How Fast Can You Go?".
   a) What is the difference between these two challenges?

   b) How would the design of your car differ for each one?

   c) Every team is expected to choose between designing a car that will go a long distance or designing a car that will cover a short distance (i.e. 5 meters) the fastest. Which one will your team do?

   d) What helpful hints will you try to use in your car and how will you use them?

PART II: Scientific Concepts Related to the Mousetrap Car

- Reducing Fluid Friction
- Newton's First Law of Motion
- Newton's Laws 1 and 2
- Newton's Second Law of Motion
- Rotational Inertia
- Energy
- Power
- Wheels and Axles
- Torque
- String Tension and Torque

Reminder: Everything must be in your own words!

1. Fluid Friction
   a. In your own words, what is fluid friction? (*You will need to use the Internet (include the resource with your answer - a cut&paste of the URL is fine)?*

   b. What is the source of fluid friction affecting your car?

   c. How will you reduce fluid friction on your car?

2. Newton's First Law of Motion.
   a. In your own words, describe Newton's First Law of Motion?

   b. What is inertia?

   c. How is mass related to inertia?

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3. Newton's 1st and 2nd Laws
    a. How does mass affect acceleration and inertia?

    b. What materials are you planning on using for the frame of your car?

    c. What is the scientific formulation relation acceleration, mass, and Force?
        i. For this project, what mass will you measure to help you determine acceleration and Force?

        ii. What is the source of the Force in this project?

4. Newton's Second Law of Motion
    a. What is acceleration?

    b. What is Newton's Second Law of Motion (in your own words!)?

    c. How do force and mass affect acceleration(if you increase or decrease force or mass what is the result on acceleration) ?

    d. How will you use Newton's 1st and 2nd laws in the design of your car?

    e. How will you determine the Force that was exerted on your car by the Mousetrap?

5. Rotational Inertia
    a. What is rotational inertia?

    b. What is rotational inertia depend on?

    c. What is the effect of increasing rotational inertia in the mousetrap car?

    d. What is the effect of decreasing rotational inertia in the mousetrap car?

    e. Will you be increasing or decreasing rotational inertia in your design?

6. Energy
    a. Energy is the mover of _____

    b. Energy has the ability to do _____

    c. What is the definition of work?

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   d. What is the formula for work?

   e. What is potential energy?

   f. What is power and how is it related to work?

   g. How is power related to acceleration?

   h. How does the arm-lever length, string, wheel/axle relationship, and placement of the mousetrap affect power output?

   i. Depending on the type of car you choose to build, you will want to minimize or maximize power output. What will you be doing with your car?

7. Wheels and Axles
   a. How does the axle-to-wheel ratio affect your car?

   b. In your design will you be aiming for a large or small axle-to-wheel ratio?

8. Torque
   a. What is torque?

   b. How will you use the concept of torque on your mousetrap car?

9. String Tension and Torque
   a. What role will string tension play in the success of your car?

   b. How will changing the length of the lever arm affect the success of your car?

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PART III: MEASUREMENTS

Fill in the Blanks

Measurement	Abbreviation	Units
Distance		
Time	t	seconds
Length of string	l_s	
Length of arm lever	l_{al}	
Mass		

Initial CALCULATIONS

Fill in the Blanks

Calculation	Formula	Units
Acceleration		
Force		
Speed		

Final CALCULATIONS

Fill in the Blanks

Calculation	Formula	Units
Potential Energy		
Efficiency of Design		
Power		
Torque		

Advanced Data Analysis

Fill in the Blanks

Calculation	Formula	Units
Friction		