Names: _____ Period _____

TEAM NAME: _____

Pasta Pod Challenge!

Your Challenge (aka Learning Target):
I can construct a "race car" that will roll down ramp and across the floor.
I can explain how my race car, made out of pasta, demonstrates Newton's 3 Laws of Motion!

Newton's Laws of Motion:
1st Law - A body in motion will stay in motion, or a body at rest will stay at rest, unless acted upon by an outside force (this is inertia)
2nd Law - The change any force makes in the motion of an object depends on the mass and acceleration of the object F = m x a (momentum)
3rd Law - For every action there's an equal and opposite reaction

KEY TERMS:
Friction - The force that one surface exerts on another (when two surfaces rub together)
Gravity - The force that pulls objects on Earth towards it's center
Air Resistance - The frictional force created by the air
Momentum - The force of movement that is **affected by an object's mass and velocity**
Speed - The distance an object travels in a given time
Velocity - The speed of an object in a given direction
Acceleration - the change in speed or direction of an object in motion

Procedure and RUBRIC:

1. Brainstorming and questioning - You and your partner need to think about the design you want to create for your Pasta Pod. Now that you have seen the materials, you need to think about what pasta shapes you want to incorporate into your design. You also should consider the Key Terms and Newton's Laws above. What will make the best Pasta Pod?
2. **(15 points includes filling out Data Table below)** Use graph paper to DRAW and LABEL a scaled model of your hypothesized car that is in centimeters (what are the measurements of the pasta?) (See sample)
3. Show Ms. Sacchetti the design you have come up with **for approval**
4. Fill out the data table with the car's final dimensions:

Length (cm)	Width (cm)	Height (cm)	Mass (g)

5. Now you are ready to start constructing your pasta pod - gather the materials you think you need to complete your design at a gluing station USE CAUTION WITH THE HOT GLUE GUN - **Your area needs to be back in place before leaving the classroom! That means . . . CLEAN UP :-)**

6. Use a sharpie to label your baggie of supplies and to put your names on the bottom of your car after you start construction. **Everything for your pasta pod, including this paper, goes into your bag.**
7. The TEST DRIVE - Take your pasta pod to the track. Place car on top of track and release. Measure the distance it traveled in centimeters **from the end of the track to the front of the car.** Record distances in data table for 3 trials and then calculate the average distance (rounded to the whole #) your pasta pod traveled.

****REDESIGN YOUR PASTA POD ANY TIME DURING PRACTICE TRIALS** - You CAN NOT completely start over! Modifications can be made right up until the day of the Final Races!

DATA Table: **(5 points)**

Team Name	Trial **1** (cm)	Trial **2** (cm)	Trial **3** (cm)	Average Distance (cm)

8. COMPETITION - Each Pasta Pod Team will compete in 3 Heats, **with the opportunity to make modifications between each trial.** The distances will be measured. Record distances in the **Competition Data Table**. FIND THE AVG. DISTANCE TRAVELED FOR EACH TEAM (Round to the nearest whole number).

9. **(10 points)** Now your team must come up with a modification to your design that must represent NEWTON'S THIRD LAW OF MOTION. What could you possibly do? What materials could you use? **Explain your idea and what materials you would need here**:
_____
_____
_____
_____
____
_____
_

10. Using your Pasta Pod, how could you determine the speed that it can travel in? Explain your method, test your method, and tell what your results were: **(10 points)**
_____
_
_____
_____
_____
___

11. **(10 points) Extra credit** - add modifications to prove Newton's 3rd Law of Motion: **Show and demonstrate to the class your Newton's 3rd Law design of your Pasta Pod, explaining how it represents the 3rd law.**

Name _____ Per_____

Competition Data Table **(10 points)**

Team Name	Heat 1 (cm)	Heat 2 (cm)	Heat 3 (cm)	Average (cm)

Pasta Pods Project Conclusion Questions

Answer using complete sentences on a separate piece of paper and be sure to **use data** as needed from the trials/heats **to support your answers. (10 points each = 50 pts)**

1. How can you relate EACH of Newton's 3 Laws of Motion to the Pasta Pod Challenge?
   a.) Newton's 1st Law
   b.) Newton's 2nd Law
   c.) Newton's 3rd Law

2. a.) What was the average distance your pasta pod traveled and how did this compare to other pasta pods in your class? (Was your pasta pod designed to travel farther, about the same as most, or did it travel the least distance?) **Provide avg. distances as evidence!**
   b.) What could you have done differently to make your Pasta Pod a better design?

3. Which pasta pod in your class traveled on average the farthest? What was it about their (or your) design that allowed for that pasta pod to go as far as it did? Give a detailed explanation.

4. What would happen to a pasta pod if mass was added? (Please refer to Newton's 2nd Law of Motion.) Include how acceleration, speed, and distance might be affected.

5. What would affect the outcome if two pasta pods collided with each other either if one hit the other from another from behind, or if two hit head on?

   Use and **highlight** the terms speed, acceleration, velocity, mass, and force to describe how these variables would affect a collision.