Name: Hour:

# Motion Unit Assessment - Due 7/8 Oct

We are losing customers at our amusement park! Our advertising department has tasked your group to create a new roller coaster that will attract the masses. This roller coaster must be fast, flashy, and, most importantly, safe! One roller coaster idea will be selected from each class to be built at our amusement park. At the end of your testing you will need the final specifications of your roller coaster to present to the advertising department.

Criteria:

- Your roller coaster must have at least two of the following features
  - loop, hill, jump, spiral, corkscrew
- The marble must make it from the beginning hill to the cup at the end
- The group must use the entire length of the tube for the roller coaster
  - Hint, two pieces put together = total length in meters, measure this before you start!
- The roller coaster must be built in such a way that it can be taken apart at the end of class without damaging the foam tubing
  - **ABSOLUTELY no cutting, tearing, or bending the tubing!**

## Proficiency Scales - Student can...

| | **Newton's 2nd Law** | **Momentum** | **Energy** |
|---|---|---|---|
| 4 | Calculate the force for multiple marble materials.<br><br>Compare and contrast the effect multiple marble materials has on the *forces* in the roller coaster. | Calculate momentum for multiple marble materials.<br><br>Compare and contrast the effect multiple marble materials has on the *momentum* in the roller coaster.<br><br>Design a safe roller coaster, the cup that catches the marble moves less than 5cm. | Calculate the potential and kinetic energy for multiple marble materials.<br><br>Compare and contrast the effect multiple marble materials has on the *energy* in the roller coaster.<br><br>Calculate in a design feature how the energy changes and why. |
| 3 | Calculate the force at some point in the roller coaster.<br><br>Define and describe the relationship between force, mass, and acceleration. | Calculate momentum at some point in the roller coaster.<br><br>Design a safe roller coaster, the cup that catches the marble moves less than 10cm. | Calculate the potential and kinetic energy at some point(s) in the roller coaster.<br><br>Explain in a design feature how the energy changes and why. |
| 2 | Calculate the force at some point in the roller coaster, with minimal errors.<br><br>Define the relationship between force, mass, and acceleration. | Calculate momentum at some point in the roller coaster, with minimal errors.<br><br>Design a safe roller coaster, the cup that catches the marble moves less than 15cm. | Calculate the potential and kinetic energy at some point(s) in the roller coaster, with minimal errors.<br><br>Explain in a design feature how the energy changes. |
| 1 | Build a roller coaster structure but can not use force to explain how it works. | Build a roller coaster structure but can not use momentum to explain how it works. | Build a roller coaster structure but can not use kinetic or potential to explain how it works. |

# Planning

## Newton's 2nd Law

What do you need to measure to calculate the force on the marble? How are you going to measure it?

| What? | How |
|---|---|
| | |
| | |
| | |

## Momentum

What do you need to measure to calculate the momentum? How are you going to measure it?

| What? | How |
|---|---|
| | |
| | |
| | |

## Energy

What do you need to measure to calculate potential and kinetic energy in the roller coaster? How are you going to measure it?

| What? | How |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

Name: Hour:

# Roller Coaster Design

Draw a DETAILED picture of your roller coaster that includes measurements in the space below. Be sure to reference heights (from the ground up), distances between track components, etc. Someone else should be able to construct your track solely from this drawing. Label the drawing with the letters listed in the table below to indicate where you measured those values.



# Measurements

*Note, only one marble material is needed to get a 3.*

| Label | Quantity | Steel Marble | Wood Marble | Glass Marble |
|---|---|---|---|---|
| **A** | **Force** | | | |
| **B** | **Momentum** | | | |
| **C** | **PE** | | | |
| **D** | **KE** | | | |

Name: Hour:

# Sales Pitch

This is where you are going to sell me on your roller coaster as the most awesome. You should include things like:

- Highest height, speed, name, runtime, description of roller coaster, safety, etc.

This is also where you should compare and contrast materials if you are going for a 4. Pretend that you are planning for different types, or capacities of cars. Remember, include ANYTHING you think is necessary to get the grade you want.