**Name: Date: Period:**

**Your Goal:** Your group you must **design, build, and market** a complex ride that will demonstrate:

* How the following **forces** affect motion: **gravity, air resistance, static friction, kinetic friction (rolling AND sliding)**
* **Newton’s 3 laws of motion.**
* The relationship between **speed**, **acceleration, & terminal velocity**.
* **Research information** pertinent to your ride.

**PLEASE REFER TO THE RUBRICS FOR INFORMATION ON HOW THIS PROJECT**

**WILL BE GRADED!**

**Your Provided Materials:**

1. Cardboard tubes
2. Masking tape
3. Basic Art Supplies
4. Rolling objects
5. Legos

Your team can agree to purchase and/or bring additional items from home to use as building and/or decorating materials. ASK your teacher about supplies you need BEFORE your purchase them. Your teacher may have some of your needed supplies that you can use.

**HOW THIS PROJECT WORKS:**

1. **Plan your ride**: Draw a sketch of what you would like to build. Explain or label where your ride will demonstrate the requirements. Discuss a name and a theme. Your drawing must be approved **BEFORE** you begin building.
2. **Make a brochure/research ride**: Your group will be responsible for designing a way to present researched and required content. Researched work can be designed and turn in in any of the following ways:
3. T**yped or NEATLY handwritten** in brochure form or on poster board - designed to entice people to visit your ride.
4. Electronically produced using computer program (PPT, etc.)
5. Video (skit or presentation of information)

Your brochure **MUST** include **ALL** components outlined below. Written parts will be assigned to individual group members, however, **ALL** group members are responsible for knowing all information, as you may present any part.

1. **Build your ride**: This will be done in class, however, **you must be prepared to build by BRINGING YOUR MATERIALS AND IDEAS with you**. Ride MUST be easily transported through doorways and fit on a science table. Place flags on your ride to indicate where the required parts can be found.
2. **Present and demonstrate your ride**: Your group will explain how your ride meets all of the requirements.



**REQUIREMENTS FOR BROCHURE COMPONENTS AND CLASS PRESENTATION:** (\* = parts can be started before ride is complete.)

A**) Forces & Energy** – One group member must write about the forces demonstrated on your ride. ***You will need to write an introductory paragraph then include the following information using several well-developed paragraphs***:

**General Info. – Forces and Energy:**

1. Define forces.\*
2. Provide specific definitions of balanced and unbalanced forces with real-life examples.\*
3. Define energy.\*
4. Provide specific definitions and explanations for the difference between potential energy and kinetic energy.\*
5. Explain the importance of forces and energy in amusement park rides.\*

**Gravity:**

* + - * 1. Define gravity.\*
        2. How does mass affect the magnitude of gravitational force?\*
        3. Explain the role of gravity in a specific location on your ride.

**Air Resistance:**

1. Define air resistance.\*
2. Compare the directions of air resistance and gravity forces.\*
3. Explain the role of air resistance in a specific location on your ride.

**Static Friction:**

1. Define static friction.\*
2. Explain and give an example of the importance of static friction in everyday life.\*
3. Explain the role of static friction using a specific location on your ride. Include the two surfaces involved.

**Kinetic Friction:**

1. Define kinetic friction including specific definitions of the two types (rolling and sliding friction).\*
2. Explain how friction affects the motion of objects using real-life examples.\*
3. Explain the role of rolling friction using a specific location on your ride. Include the two surfaces involved.
4. Explain the role of sliding friction using a specific location on your ride. Include the two surfaces involved.

B**) Newton’s Laws** – One group member must write about the laws of motion demonstrated on your ride. ***The write up should include an introductory paragraph then include the following information using several well-developed paragraphs*:**

**Research:**

1. Sir Isaac Newton – Short biography\*
2. Explain what he is best known for.\*
3. What is/was his contribution to Math and Science?\*
4. Find out whether an apple ACTUALLY hit his head.\*

**1st Law, 2nd Law, 3rd Law: You must complete the following information FOR EACH LAW:**

1. Explain the 1st, 2nd, and 3rd Laws.\*
2. Give a real-life example of Newton’s 1st, 2nd, and 3rd Laws.\*

**Specific Information for Newton’s Laws:**

1. Explain how and where on your ride **Newton’s 1st** Law is demonstrated. Please include the role of inertia, the unbalanced force that causes a change in motion, and how the motion would be affected without the unbalanced force.
2. Explain how and where on your ride **Newton’s 2nd** Law is demonstrated. Please include the relationship between force, mass, and acceleration. Include how changing one or more of the above will affect the others.
3. Explain how and where on your ride **Newton’s 3rd** Law is demonstrated. Please include the action (with direction), and the reaction (with direction).
4. **Acceleration/Speed** – One group member must write about the 3 types of acceleration demonstrated on the ride, and calculate the average speed of your marble. ***The write-up should include an introductory paragraph and written in several well-developed paragraphs:***

**Research:**

1. The tallest/fastest ride in the US/World & its construction.\*
2. The dangers high-speed rides pose to the public – including why parks have height and health restrictions. Have there been any accidents, deaths, and/or safety concerns about your ride?\* If certain rides can be dangerous, what attracts people to them?\*
3. Define terminal velocity and explain how and why it is or is not shown on your ride.\*

**Speed/Acceleration:**

1. Define speed and explain what average speed is.\* Include a real-life example.\*
2. Provide a general definition of acceleration and specific definitions for each type with real-life examples.\*
3. Explain how speed is related to acceleration.\*
4. Describe, in words, where each type of acceleration is demonstrated on your ride.
5. Explain how you know each type of acceleration is occurring on the ride.

**Calculations and graph:**

1. Time your marble and **calculate the average speed** at which it travels through the ride three times. **You will need to measure your ride using centimeters in order to do this! Use the formula: S = D/T**
2. Show calculations and measurements for average speed of marble (with all work and units)
3. Make a graph of your three trials showing the speed of your ride.
4. **History/Impact** – One group member must research information specific to your ride using at least 3 different sources and write about it. Keep in mind the following question: *Why do people love amusement park rides?* The write-up should be written in several ***well-developed paragraphs***.
5. History and or evolution of your ride - Where did the idea for your type of ride first originate? How has the ride changed over time?\*
6. Describe how the building of an amusement park might impact the environment and the surrounding community? Think about traffic, water, garbage, hotels, jobs, open space, wildlife, etc. when conducting your research for this question.
7. In your opinion, why is your ride the one people should pay and wait in line for?\* Include the special features of your ride and persuade us to ride it!\* (You will read this part to the class during presentations.)
8. **Reflect** – The team must write about your group’s experience in this building process. Use your engineering log to help you. This portion of the write-up should be written in several ***well-developed paragraphs.*** Include the following information:
9. How well did your team work together? How did you handle differences of opinion when they arose? How did your group react to new ideas or changes in your design plan?
10. Discuss some things that you and your team members are proud of regarding your project.
11. What challenges did you and your team face? Discuss changes you made, reasons you made the changes and whether or not those changes worked.
12. What do you want people to know about this project and/or your ride?
13. What do you hope people say about your ride?
14. Your original stamped design sketch
15. ***Make a new sketch that represents your final project.***



**Rubric for your brochure! (80 pts)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Fabulous!**  **8** | **All right!**  **6** | **Needs work**  **4** | **Little Effort**  **2** |
| **Brochure Design** matches theme, is neat, creative, and includes all required parts | **Brochure Design** is neat and creative but is missing 1 part or is not creative. | **Brochure** is neat and includes only 2 of the required parts or includes 3 parts but not decorated. | **Brochure** looks hastily put together or includes only 1 of the required parts. |
| **Forces** section is correct and complete for **all 5** required parts | **Forces** section is correct and complete, for 4 required parts or has partial or incorrect information in one part | **Forces** section is correct and complete, for 3 required parts or has partial or incorrect information in two parts | **Forces** section is correct and complete, for 1-2 required parts or has partial or incorrect information in 3-4 parts |
| **Forces** section is neatly written/typed and has **very few** spelling and grammatical errors | **Forces** section is neatly written/typed but has a few spelling or grammatical errors | **Forces** section is not neatly written/typed or has several spelling and grammatical errors | **Comprehension of information is difficult** due to many spelling and/or grammatical errors or penmanship |
| **Newton’s Laws** section is correct and complete for **all 3** required parts | **Newton’s Laws** section is correct and complete, for 2 required parts or has partial or incorrect information in one part | **Newton’s Laws** section is correct and complete, for 1 required part or has partial or incorrect information in two parts | **Newton’s Laws** section contains partial or incorrect information in 3 parts |
| **Newton’s Laws** section is neatly written/typed and has **very few** spelling and grammatical errors | **Newton’s Laws** section is neatly written/typed but has a few spelling or grammatical errors | **Newton’s Laws** section is not neatly written/typed or has several spelling and grammatical errors | **Comprehension of information is difficult** due to many spelling and/or grammatical errors or penmanship |
| **Acceleration/Speed** section is correct and complete for **all 3** required parts | **Acceleration/Speed** section is correct and complete, for 2 required parts or has partial or incorrect information in one part | **Acceleration/Speed** section is correct and complete, for 1 required parts or has partial or incorrect information in 1-2 parts | **Acceleration/Speed** section contains partial or incorrect information in all 3 parts |
| Acceleration/Speed section is neatly written/typed and has **very few** spelling and grammatical errors | **Acceleration/Speed** section is neatly written/typed but has a few spelling or grammatical errors | **Acceleration/Speed** section is not neatly written/typed or has several spelling and grammatical errors | **Comprehension of information is difficult** due to many spelling and/or grammatical errors or penmanship |
| **History/Impact** section is correct and complete for **all 3 required parts** | **History/Impact** section is correct and complete, for 2 required parts or has partial or incorrect information in one part | **History/Impact** section is correct and complete, for 1-2 required parts or has partial or incorrect information in 2 parts | **History/Impact** section contains partial or incorrect information in 3 parts |
| **History/Impact** section is neatly written/typed and has **very few** spelling and grammatical errors | **History/Impact** section is neatly written/typed but has a few spelling or grammatical errors | **History/Impact** section is not neatly written or typed or has several spelling and grammatical errors | **Comprehension of information is difficult** due to many spelling and/or grammatical errors or penmanship |
| All sources used have complete citations. |  | Citations are missing for some sources or are incomplete. |  |

**Brochure Total: /80**

**Rubric for your ride and presentation! (40 pts)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Fabulous!**  **4** | **All right!**  **3** | **Needs work**  **2** | **Little Effort**  **1** |
| Ride is structurally sound and within size requirements | Ride is structurally sound or within size requirements | Ride is not very structurally sound or isn’t within size requirements | Ride easily falls apart or is well outside the size requirements. |
| Ride is complex, is creatively themed, and all required parts | Ride is complex and has some decoration/theme or is not complex but with clear theme | Ride is somewhat complex but has with little decoration OR decorated but ride is not complex | Ride is very simple, without decoration |
| All 11 requirements are clearly and correctly labeled | Has 8-10 clear and/or correct labels. | Has 5-7 clear and/or correct labels. | Has 1-4 clear and/or correct labels. |
| Ride runs successfully 2 times in a row on the first try | Ride runs 2 times in a row but took several tries | Ride runs 2 times (not in a row) | Ride runs successfully through ride only once. |
| Ride demonstrates all 11 requirements. | Ride demonstrates 8-10 requirements. | Ride demonstrates 5-7 requirements. | Ride demonstrates 1-4 requirements. |
| Presentation is 6 minutes or less (including set-up) |  | Presentation is more than 6 minutes. |  |
| All parts are presented using appropriate eye contact, adequate volume, and clear pronunciation. | 3 out of 4 parts are presented using appropriate eye contact, adequate volume, and clear pronunciation. | 2 out of 4 parts are presented using appropriate eye contact, adequate volume, and clear pronunciation. | 1 out of 4 parts are presented using appropriate eye contact, adequate volume, and clear pronunciation. |
| Presentation was completed with 0-2 teacher prompts for information. | Presentation was completed with 3-5 teacher prompts for information. | Presentation was completed with 6-8 teacher prompts for information. | Presentation was completed with more than 9 teacher prompts for information. |
| All parts of the presentation are prepared and speakers are knowledgeable about the requirements | 3 out of 4 parts of the presentation are prepared and speakers are knowledgeable about the requirements | 2 out of 4 parts of the presentation are prepared and speakers are knowledgeable about the requirements | 1 out of 4 parts of the presentation are prepared and speaker is knowledgeable about the requirements |
| Project AND Brochure are completed on time |  | Project or Brochure is one day late |  |

**Ride/Presentation Total: /40**

Comments:

This project is worth 170 points!

Ride/Presentation Rubric Total: /40

Brochure Rubric Total: /80

Group Project Total: /120

\*The additional 50 points will be based on individual participation grades.