Physics 100 (Stapleton) Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Newton’s Laws

Newton Sled Activity

**Newton’s Laws:**

**1st Law:** O*bjects in motion remain in motion in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and objects at rest \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, unless they are acted upon by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.*

**2nd Law: Force = mass x acceleration**

**3rd Law: For every action (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_), there is an equal and opposite reaction (\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).**

1. According to Newton’s 1st Law, *when the forces acting on an object are* ***balanced***, what does the object do?

2. According to Newton’s 1st Law, *when the forces acting on an object are* ***not balanced*** (i.e. there is an unbalanced force acting on the object), what does the object do?

3. When two variables are ***directly*** *proportional*, a change in the first variable will cause \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change in the second variable.

4. When two variables are ***inversely*** *proportional*, a change in the first variable will cause \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ change in the second variable.

**Inertia**: resistance to change in motion.

5. An object’s inertia is directly proportional to its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. In other words,

**Newton Sled Activity Directions**: Complete questions 1-9. After question 1, fill in the chart on the back by conducting trials with a “Newton Sled.”

1. Before you start, answer this question. Newton’s 3rd Law tells us that, in every trial, the action force pushing the slingshot will be the same as the reaction force pushing the projectile. In light of that, why will the slingshot and the projectile usually move different distances?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Trial** | **# of Rubber Bands** | **Mass of Sled (g)** | **Mass of Projectile (g)** | **Describe Sled movement** | **Describe Projectile Movement** |
| **1** |  |  |  |  |  |
| **2** |  |  |  |  |  |
| **3** |  |  |  |  |  |
| **4** |  |  | **Entire Earth**  **( )** |  |  |
| **5** |  |  | **Ping Pong Ball**  **( )** |  |  |
| **6** |  |  |  |  |  |
| **7** |  |  |  |  |  |
| **8** |  |  |  |  |  |

2. Consider Newton’s 2nd Law, F=ma. What provides the Force (F) in this activity?

Consider situations in which a force is applied to an object, causing it to accelerate.

3. If you apply the same force to an object, what happens to the object’s acceleration if you increase the obect’s mass?

4. If you apply the same force to an object, what happens to the object’s acceleration when you decrease its mass?

5. If you keep an object’s mass the same, what happens to the object’s acceleration when you increase the force applied to the object?

6. According to your Newton Sled observations and Newton’s 2nd Law, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are directly proportional, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are inversely proportional.

Consider the ping pong ball launch…

7. Compare the force that pushes the ping pong ball to the force that pushes the Newton sled. How do the forces compare?

8. Support your answer using one of Newton’s Laws.

9. What accounts for the different accelerations that you observe?