Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Exploring Forces: Exploration One**

**Exploring Speed**

**Directions:** Put **one** book under the ramp. With the stopwatch, measure how long it takes for each ball to roll from the *top* of the ramp to the *bottom* of the ramp. Then *circle* the ball that rolled the fastest.

**Predict:** Which ball (small, medium, or large) do you predict will roll the fastest? Why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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|  |  |
| --- | --- |
| **Ball Size** | **Time (s)** |
| Small |  |
| Medium |  |
| Large |  |

**Directions:** Put **two** books under the ramp. With the stopwatch, measure how long it takes for each ball to roll from the *top* of the ramp to the *bottom* of the ramp. Then *circle* the ball that rolled the fastest.

|  |  |
| --- | --- |
| **Ball Size** | **Time (s)** |
| Small |  |
| Medium |  |
| Large |  |

Did adding a book under the ramp change the time it took the balls to roll? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Distance Traveled**

**Directions:** Put **one** book under the ramp. With the meter stick, measure how far each ball rolls from the bottom of the ramp. Circle the ball that went the farthest.

**Predict:** Which ball (small, medium, or large) do you think will go the farthest? Why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data Collection**

|  |  |
| --- | --- |
| **Ball Size** | **Distance Traveled (meters)** |
| Small |  |
| Medium |  |
| Large |  |

**Directions:** Put **two** books under the ramp. With the meter stick, measure how far each ball goes from the bottom of the ramp. Circle the ball that traveled the farthest.

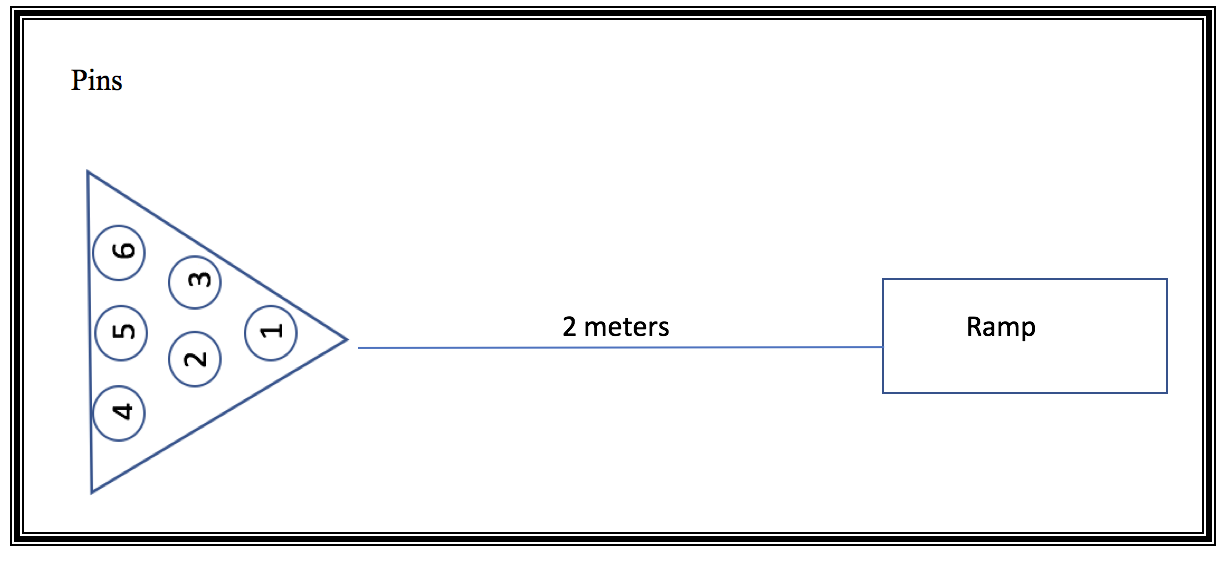
|  |  |
| --- | --- |
| **Ball Size** | **Distance Traveled (meters)** |
| Small |  |
| Medium |  |
| Large |  |

Did the number of books under the ramp change how *far* the balls went? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Bowling with Forces: Exploration Two**

**Directions:** Put 6 water bottles in a triangle, 2 meters away from the bottom of the ramp. Put **one book** under the ramp. Write down how many pins are knocked down with each ball (small, medium, and large)



1. Does a push or a pull force cause the pins to move? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. What object puts the force on the pins? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Which ball knocked down the most pins? Why do you think this happened? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data Collection:**

|  |  |  |
| --- | --- | --- |
| Ball Size | Number of Pins Knocked Down: Roll 1 | Number of Pins Knocked Down: Roll 2 |
| Small |  |  |
| Medium |  |  |
| Large |  |  |

**Directions:** Place 6 water bottles in a triangle, 2 meters away from the bottom of the ramp. With **two books** under the ramp, write down how many pins are knocked down with each ball (small, medium, and large).

|  |  |  |
| --- | --- | --- |
| Ball Size | Number of Pins Knocked Down: Roll 1 | Number of Pins Knocked Down: Roll 2 |
| Small |  |  |
| Medium |  |  |
| Large |  |  |

**Extend**

**Directions:** Put **2 books** underneath the ramp. Complete two rolls with each ball and write the data in the table. Next, put **3 books** under the ramp and complete two rolls with each ball. Write down the data in the table.

**Predict:** Which ramp (1 book, 2 books, or 3 books) will make the ball hit the pins with more force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Data Collection**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Ball Size | Number of Pins Knocked Down: Two Books | | Number of Pins Knocked Down: Three Books | |
| Trail 1 | Trail 2 | Trial 1 | Trial 2 |
| Small |  |  |  |  |
| Medium |  |  |  |  |
| Large |  |  |  |  |

1. Does the size of the ball change the amount of force the ball puts on the pins? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Does the number of books under the ramp affect the force of the ball hitting the pins? Why or why not? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Which ball (small, medium, or large) and ramp (1 book, 2 books, or 3 books) would you use to place the strongest push on the pins?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_