**Student Worksheet: The Pickleball Pickle**

**Qualitative vs. Quantitative**
Receive one indoor pickleball, one outdoor pickleball, one wiffle ball and at least one pickleball paddle or wiffle bat from your teacher. Identify where your teacher has placed additional materials and follow the instructions on your worksheet to conduct a qualitative experiment.

**Qualitative Experiment**

1. Write a description of each ball in the first row of the table. For example, you could describe the surface texture of the balls, the shape and number of any holes, their relative size and weight, etc.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Indoor Pickleball | Outdoor Pickleball | Wiffle Ball | Ping-Pong Ball |
| Description |  |  |  |  |

2. Why do you think these balls look and feel different?

3. Hit and throw each ball to observe their behavior. Record your observations in the table provided.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Indoor Pickleball | Outdoor Pickleball | Wiffle Ball | Ping-Pong Ball |
| **Behavior:** Hitting the Ball |  |  |  |  |
| **Behavior:** Throwing the Ball |  |  |  |  |

4. Use the materials provided to alter each ball and hit and throw the altered balls to observe their behavior. Make sure you are hitting and throwing the ball in the same way as you did during your initial observation period. Record your alterations and observations in the table provided.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Indoor Pickleball | Outdoor Pickleball | Wiffle Ball | Ping-Pong Ball |
| Describe Alteration |  |  |  |  |
| Observed Behavior: Throwing the Ball |  |  |  |  |
| Observed Behavior: Hitting the Ball |  |  |  |  |

**Drag**

Read the *Science News Explores* article, “[Pickleballs inspire a new way to reduce drag on vehicles](https://www.snexplores.org/article/dimples-reduce-drag-vehicles)”  and answer the associated questions.

1. What is drag?

2. Why do you think some of the balls you were provided with have holes? How can these holes be related to drag?

3. Explain one way in which you observed drag while testing each ball.

4. How did you change the way each ball experienced drag using the provided materials?

**Quantitative Experiment**

Measure your control group and intentionally design your pickleball to complete your assigned challenge, being careful not to significantly change your pickleballs weight. Use the questions below to facilitate your quantitative experiment.

1. Circle your challenge: Fastest Drop Slowest Drop Farthest Horizontal Drop

2. What are the control variables? What will stay the same across all your trials?

3. What is your independent variable? What are you changing?

4. What is your dependent variable? What are you measuring? Include units.

5. Create a hypothesis for your quantitative experiment.

6. Use a scale to measure the weight of the outdoor pickleball and use the tape measure to measure the

7. Ball weights must remain constant between the control group and each trial. How can you adjust the

8. Your experiment will need to have a control group. This is separate from your control variables. What is your control group?

9. Measure the amount of time it takes for your outdoor pickleball to fall three times for the control group and each trial. Record your independent and dependent variables in the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Control | Trial 1 | Trial 2 | Trial 3 |
| Independent Variable: How was this ball altered? |  |  |  |  |
| Dependent Variable: Measurement 1 |  |  |  |  |
| Dependent Variable: Measurement 2 |  |  |  |  |
| Dependent Variable: Measurement 3 |  |  |  |  |

10. Which trial was most successful? Was your initial hypothesis supported or unsupported?

11. Why did your group choose to make the alterations you did? Describe how your findings relate to the findings from the article and your observations during the qualitative experiment.

12. How did your qualitative experiment inform what you did in your quantitative experiment?

13. What type of experiment do you think would be more important for a pickleball player when deciding what kind of pickleball to purchase? Why?

14. What type of experiment would be more important for a scientist studying drag or a pickleball manufacturer? Why?