**Background:** As a group, you have constructed a variety of mechanical windmills. Now it time to create wind turbines to test different blade variables. Previously, you found that \_\_\_\_\_\_ (*number of blades*) produced the most electrical output. Today you will be using that number of blades to explore how pitch affects electrical output.

**Independent Variable:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Dependent Variable**: Electrical output (voltage)

**Objective:** To test blade pitch for a specified number of blades. The blade pitch that results in the most electrical energy will be considered to be the most efficient.

**Question:** How does the blade’s pitch (angle) affect electrical output?

**Hypothesis:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Procedure:**

1) Construction: None required. Use the blades constructed for the number of blades lab.

2) Testing: Each blade should be the same size and attached to the hub at an equal distance (degrees apart) around the hub. The tower should be 1 meter from the face of the fan. (Use the meter stick to measure the distance between the hub of the windmill and the fan grate.) Adjust each blade to the specified pitch.

3) Data Collection: Use the digital multimeter to measure the number of volts generated at each wind speed (1, 2, and 3).

4) Clean-up: Place your blades in the designated area. (We will use the blades again in the next lab.)

**Data Collection:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Pitch of blades** | **Electrical Output (Voltage)** Wind Speed 1 / 2 /3 | **Average Electrical Output (Voltage)** | **Pitch of blades** | **Electrical Output (Voltage)** Wind Speed 1 / 2 / 3 | **Average Electrical Output (Voltage)** |
| 0 ° (White) |  / /  |  | 50 ° (White) |  / /  |  |
| 5 ° (Orange) |  / /  |  | 55 °(Orange) |  / /  |  |
| 10 ° (Pink) |  / /   |  | 60 °(Pink) |  / /   |  |
| 15 °(Green) |  / /  |  | 65 °(Green) |  / /  |  |
| 20 °(Blue) |  / /  |  | 70 °(Blue) |  / /  |  |
| 25 °(Purple) |  / /  |  | 75 °(Purple) |  / /  |  |
| 30 ° (Yellow) |  / /  |  | 80 ° (Yellow) |  / /  |  |
| 35 ° (White) |  / /  |  | 85 ° (Orange) |  / /  |  |
| 40 °(Pink) |  / /  |  | 90 ° (Green) |  / /  |  |
| 45 °(Blue) |  / /  |  |  |  |  |

Graph of average electrical output and number of blades.



**Conclusion:**

1) What was the overall purpose of this experiment?

2) What does the data say about the relationship between the pitch of blades and the electrical output (voltage)?

3) Does the data support your hypothesis? Why or why not?

4) How could errors in the data be introduced into this experiment?

5) How could this experiment be improved or changed?

6) What could be studied next? How would you set up an experiment to study your idea?