MATERIALS PAGE

You will only have access to the following materials.

1) Go through the bolded words and circle if it is a changing variable and underline if it is a control. Example Control: Blade Material, Example Changing Variable, Blade Number.
2) For variables that are controls, select 1 underlined value. When a variable is a control you will only have access to the underlined values.
3) For the variable that is the changing variable, select 4 values and write the trial letter (A, B, C, D) next to each value. Example: □ Cardstock (original) A

General Materials:
- Wind turbine base
- Multimeter
- Measuring tape
- Binder Clips
- (2) Swing arm protractor
- Wind turbine protractor

Blade Material:
- Kleenex
- Paper
- Styrofoam
- Metal
- Paper towel
- Cardstock (original)

Blade Number:
- □ 1
- □ 2
- □ 3 (original)
- □ 4
- □ 5
- □ 6

Weight Number:
- □ 0
- □ 3 (original)
- □ 6
- □ 9
- □ 12
- □ 15
- □ 18
- □ 21
- □ 24

Weight Placement:
- □ 0 cm
- □ 1 cm
- □ 2 cm
- □ 3 cm
- □ 4 cm
- □ 5 cm
- □ 6 cm (original)
- □ 7 cm
- □ 8 cm
- □ 9 cm
- □ 10 cm
- □ 11 cm

**Note:** if you are changing Number of Weights, you may only place your weights at 6 cm.

Dowel Placement:
- □ 0.5 cm
- □ 1 cm
- □ 1.5 cm
- □ 2 cm
- □ 2.5 cm
- □ 3 cm (original)
- □ 3.5 cm
- □ 4 cm
- □ 4.5 cm
- □ 5 cm
- □ 5.5 cm
- □ 6 cm

Blade Angle:
- □ 0°/180°
- □ 10°
- □ 20°
- □ 30°
- □ 40° (original)
- □ 50°
- □ 60°
- □ 70°
- □ 110°/70°
- □ 120°/60°
- □ 130°/50°
- □ 140°/40°
- □ 150°/30°
- □ 160°/20°
- □ 170°/10°

Fan Distance: Any distance between 20 cm – 100 cm (original fan distance = 60 cm)

Turbine Angle:
- □ 0°
- □ 15°
- □ 30°
- □ 45°
- □ 60° (original)
- □ 75°
- □ 90°
- □ 105°
- □ 120°
- □ 135°
- □ 150°
- □ 165°
- □ 180°
EXPERIMENTAL SET-UP

Determine the values of your changing variable (ex: number of blades) from the materials page and write the values (ex: 4) for your four trials under each wind turbine.

Changing Variable

\[
\begin{array}{cccc}
\text{Trial A} & \text{Trial B} & \text{Trial C} & \text{Trial D} \\
\end{array}
\]

Controls (variables you will hold constant):
Determine the variables that you will hold constant and indicate the specific value you will use in all your trials.

SciTrek Member Approval______________
RESULTS

Table

Fill out the chart for each of your trials. If one of the variables remains constant for all trials write the value in trial A and then draw a line through each box indicating that this variable is a control.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blade Material:</td>
<td>Paper</td>
<td>Kleenex</td>
<td>Metal</td>
<td>Styrofoam</td>
</tr>
<tr>
<td>Blade Number:</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight Number</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight Placement:</td>
<td>16 cm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dowel Placement:</td>
<td>1.5 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blade Angle: (list both the actual angle and what angle you will find on the wind turbine protractor)</td>
<td>30°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan Distance:</td>
<td>50 cm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turbine Angle:</td>
<td>90°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fan Speed</td>
<td>3/high</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Predictions

Put an “M” in the trial that will give the most current and an “L” in the trial that will give the least current.

<table>
<thead>
<tr>
<th>Predictions</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SAME</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data

<table>
<thead>
<tr>
<th>Current</th>
<th>Trial A</th>
<th>Trial B</th>
<th>Trial C</th>
<th>Trial D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.4 mA</td>
<td>0 mA</td>
<td>2.0 mA</td>
<td>1.9 mA</td>
</tr>
</tbody>
</table>

Final Observations/Measurements:

<table>
<thead>
<tr>
<th>Other:</th>
<th>Blade Bent</th>
<th>Blade Ripped</th>
<th>Blade did not bend</th>
<th>Blade did not bend</th>
</tr>
</thead>
</table>

The independent variable is the changing variable and the dependent variables are current and other.
<table>
<thead>
<tr>
<th>Group 1</th>
<th>Changing Variable:</th>
<th>Current (mA):</th>
<th></th>
<th></th>
<th></th>
<th>Summary: ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Changing Variable:</th>
<th>Current (mA):</th>
<th></th>
<th></th>
<th></th>
<th>Summary: ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 3</th>
<th>Changing Variable:</th>
<th>Current (mA):</th>
<th></th>
<th></th>
<th></th>
<th>Summary: ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 4</th>
<th>Changing Variable:</th>
<th>Current (mA):</th>
<th></th>
<th></th>
<th></th>
<th>Summary: ____________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Changing Variable:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Current (mA):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Summary:**

<table>
<thead>
<tr>
<th>Group 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Changing Variable:</strong></td>
</tr>
<tr>
<td><strong>Current (mA):</strong></td>
</tr>
</tbody>
</table>

**Summary:**
Effects of Changing Blade Angle

<table>
<thead>
<tr>
<th>Blade Angle (°)</th>
<th>Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°</td>
<td>0.0 mA</td>
</tr>
<tr>
<td>70°</td>
<td>0.2 mA</td>
</tr>
<tr>
<td>50°</td>
<td>1.7 mA</td>
</tr>
<tr>
<td>30°</td>
<td>3.3 mA</td>
</tr>
<tr>
<td>10°</td>
<td>6.5 mA</td>
</tr>
</tbody>
</table>

Controls:

Dowel Placement / 1 cm

Number of Weights / 3
Effects of Changing Dowel Placement

![Graph showing the effects of changing dowel placement on current (mA).](image)

- **Dowel Placement (cm)**: 6, 5, 3.5, 2, 0.5
- **Current (mA)**: 1.9, 2.0, 2.2, 2.6, 3.0

Controls:

- **Blade Angle**: 40°
- **Number of Weights**: 3
Effects of Changing Number of Weights

<table>
<thead>
<tr>
<th>Number of Weights</th>
<th>Current (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>3.7 mA</td>
</tr>
<tr>
<td>12</td>
<td>3.8 mA</td>
</tr>
<tr>
<td>0</td>
<td>3.8 mA</td>
</tr>
<tr>
<td>9</td>
<td>3.9 mA</td>
</tr>
<tr>
<td>6</td>
<td>3.9 mA</td>
</tr>
</tbody>
</table>

Controls:

- Blade Angle / 40°
- Dowel Placement / 1 cm