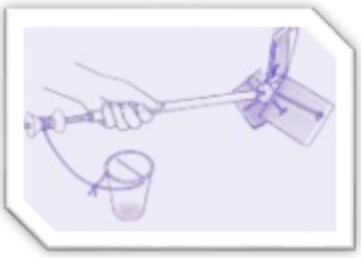
MacGyver Data Sheet

Name(s): _____



Learning Objectives:

- I can design and build a windmill using simple materials.
- I can test and analyze how blade design and friction affect windmill performance.
- I can calculate the **energy (J)** and **power (W)** produced by my windmill.
- I can explain how my windmill connects to real-world renewable energy systems.

The Problem:

How can we design a windmill that uses wind energy to lift a weight, and how much energy and power can it produce?

Pre-Build Questions

1. **Which ability test will you be testing? (Circle one)**

- Weight Lifted

- Height Lifted

2. Design Sketch: Draw your windmill design below and label the parts (**blades, hub, shaft, string/load cup**).

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Data Table

Record your test results below:

Trial	Mass Lifted (kg)	Height (m)	Time (s)	Observations

Energy & Power Calculations:

Use the formulas below to calculate energy and power for each trial:

***Energy** (J) = **Mass** (kg) × 9.8 m/s² × **Height** (m)*

***Power** (W) = **Energy** (J) ÷ **Time** (s)*

Show your calculations for one trial here:

1. _____
2. _____
3. _____

Analyze Your Windmill:

1. What changes did you make to your windmill design from Trial 1 to Trial 2?

2. How did these changes affect the performance of your windmill?

3. What is holding it back or preventing it from spinning?

4. What parts were most difficult to design and make functional?

5. How did you attach your blades?

6. Where is there friction in your design?

7. How did you reduce friction in your windmill?

8. How did you pitch or angle the blades?

9. Were your blades changing pitch frequently?

10. Did the fan work better from the front of the blades or the side?

Redesign Your Windmill

Draw your improved windmill design below and label any changes you made:

Conclusion

Why do you think your windmill worked or didn't work as well as you expected?

Real-World Connection

How does what you learned about windmill design relate to real wind turbines used to generate electricity today?