Name: _____

KidWind Design Challenge Student Datasheet

Project/Turbine Name: _____

Team Members Names:

_____

Performance Data Table

Performance Data	Trial 1	Trial 2	Trial 3
Number of Blades			
Blade Pitch			
Materials Used			
Total mass of blades (grams)	g	g	g
Length – measure from tip of blade to center of hub when mounted	cm	cm	cm
Turbine Rotor Swept Area *Area=πr²*	cm^2	cm^2	cm^2
Wind Speed Actual speed if using anemometer or use estimated speed based on type of fan	m/s	m/s	m/s
Resistor Value (ohms Ω)	Ω	Ω	Ω
Turbine Voltage	V	V	V
Turbine Power *Power=Voltage²/ Resistance* Ω	W	W	W
Turbine Efficiency Percentage *Auto-calculate at link:* *Select electrical output and then turbine power & efficiency*	%	%	%

Engineering Design Journal

1. Describe your final blade design and explain why you chose this shape:

_____

_____

Draw your blade. Measure and label blade length, width at tip & width at base.

2. Describe the variable you modified in trial #2.

_____

_____

3. Describe the variable you modified in trial #3.

_____

_____

4. What changes did you make to your turbine that led to the most performance gains?

_____

_____

5. When building and testing your turbine blades, what obstacles or challenges did you face?

_____

_____

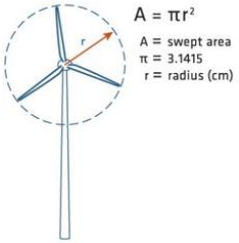
6. If you were a lead design engineer, what would you recommend your company do to their turbine blades based on the class results? Why?

_____

_____

_____

Terminology and Calculations

Term	Definition	Units	Calculations/Formula
Wind Speed:	The measurement of the speed of air flow. It is dependent on the fan setting and distance from the fan.	meters per second m/s	Measure with an anemometer (if available) or the Fan Speed Estimator in the resources.
Wind Swept Area: 	The area through which the rotor blades of a wind turbine spin, as seen when directly facing the center of the rotor blades. The power output of a wind turbine is directly related to the swept area of its blades	centimeters squared cm^2	**Formula**: $A = \pi r^2$ **Sample problem**: $A = 3.14 \times 25cm^2$ $A = 3.14 \times 625 = 1{,}963.44cm^2$
Resistance:	A property that slows the flow of electrons. Any device placed in a circuit is called a load. Every load has resistance. There are devices called resistors, with set resistances that can be placed in circuits to reduce or control the current flow.	ohms Ω	The recommended resistor for the Kidwind Turbine is 30 Ω. One was provided in your kit.
Voltage:	The pressure from an electrical circuit's power source that pushes charged electrons (current) through a conducting loop, enabling them to do work such as illuminating a light. It is electrical pressure.	volts v	The multimeter is used to measure volts in the wind turbine. A set of well designed blades may make around 1 –2 volts Typical blades will be in the 0.4 - 0.8 volt range.
Power:	The rate at which energy is generated or used. It is the measure of how fast something is generating or using energy.	watts w	Formula: watts = $Voltage^2$ / resistance Ω Sample problem: $W = .8v^2/30\ \Omega$ $W = .64\ v^2 / 30\ \Omega$ $W = 0.021$ watts
Turbine Efficiency:	A comparison of the energy output to the energy input in a given system. It is defined as the percentage ratio of the output energy to the input energy, given by the equation: Efficiency = Energy out/Energy in x 100% Wind turbines have a **maximum** theoretical efficiency of 59.3%, which is known as the **Betz limit**. Expected KidWind efficiencies are generally less than 10%.	percentage	No system is 100% efficient. Thermal energy is most frequently lost in a system. The equation to calculate turbine efficiency is complicated and requires multiple formulas. KidWind offers an efficiency calculator by entering the data collected. At the link, select electrical output and then turbine power & efficiency.