Theoretical Power Calculation

Equations:

\[
Theoretical\ Power[w] = \frac{1}{2} \cdot A \cdot \rho \cdot v^3 \cdot .59 \quad \rho = \frac{Pressure}{R \cdot Temperture}
\]

\(A=\) swept area  \(\rho=\) air density  \(v=\) velocity \(R=\) universal gas constant

Steps:

1. Measure wind speed from fan using anemometer and data logger.
   a. Low Setting: \(\underline{\quad} \) m/s
   b. High Setting: \(\underline{\quad} \) m/s

2. Record temperature of room from temperature sensor and data logger.
   a. Temp: \(\underline{\quad} \) °C

3. Calculate Swept Area \((A)\)
   a. Measure radius of turbine blade setup. Radius: \(\underline{\quad} \) m
   b. Area = \(\pi r^2 = \pi \cdot (\underline{\quad})^2 = \underline{\quad} \) m²

4. Air Density \((\rho)\)
   a. Pressure 1 inHg = 3,386.389 pascals at 0 °C
      Pressure \(\underline{\quad}\) in Hg \(*\) 3,386.39 = \(\underline{\quad}\) pa
   b. Temperature \(\underline{\quad}\) °C \(+\) 273 = \(\underline{\quad}\) °K
   c. Universal Gas Constant \((R)\)
      \(R = 287.058 \ J/(kg*K)\)
      d. \(\rho = \underline{\quad}/(\underline{\quad} \cdot \underline{\quad}) = \underline{\quad} kg/m³\)

5. Theoretical Power
   a. Low Setting Theoretical Wind Power
      i. Power= \(\frac{1}{2} \cdot \underline{\quad} \cdot \underline{\quad} \cdot \underline{\quad} \cdot .59 = \underline{\quad}\) (watts)
   b. High Setting Theoretical Wind Power
      i. Power= \(\frac{1}{2} \cdot \underline{\quad} \cdot \underline{\quad} \cdot \underline{\quad} \cdot .59 = \underline{\quad}\) (watts)
Test Turbine Power Calculation

Equations:

\[ \text{Power} = I \times V \]

\( I = \text{Current} \quad V = \text{Voltage} \)

Steps:

1. Measure the voltage from turbine using multimeter.
   a. Low Speed ______ V  High Speed ______ V
2. Measure the current using the multimeter with resistor and multimeter
   a. Low Speed ______ a  High Speed ______ a
3. Actual Power Produced from turbine
   a. Low Speed Power= _____ * _____ = ______ w
   b. High Speed Power = _____ *______= ______ w

Turbine Efficiency

Equations:

\[ \frac{\text{Actual Power Produced}}{\text{Theoretical Power}} = \eta \]

\( \eta = \text{efficiency} \)

Steps:

1. Low Speed Efficiency _____/_______ = _______ * 100 = _______%
2. High Speed Efficiency _____/_______= _______ * 100 = _______%

Summary of Results

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