# Year 10 Physics Assessment Task – Maximum Power from a Wind Turbine

**Aim:**
To investigate the maximum power which can be generated by a wind turbine.

**Method:**
In pairs or threes, you are to investigate how they can design a wind turbine to generate maximum power. The following parameters are available to manipulate:

- The type of blade (three types which vary in length, surface area, and mass)
- The number and arrangement of blades
- The angle the blades make with the wind

In order to measure the power generated by each design arrangement, multimeters will be used to measure the current and voltage, from which the power can be calculated. Students must show all raw data they have collected, making clear which design configuration is associated with each set of data, and from these, power calculations must also be shown. A minimum of three design configurations must be investigated, and each student must submit their own report.

**Due Date:**
The report is due Monday, 12 September, at the beginning of main lesson. Students who are working on their report in class on the Monday will have their reports marked late.

## Discussion Questions

In the report answers to the following questions must be included:

1. Assuming that your wind turbine runs at maximum power for one minute, calculate of how much energy is generated (in Joules).

2. Draw a Sankey diagram showing energy transformations for the wind turbine.

3. The fan used for your investigation delivers 80W of power. Assuming that your wind turbine generated less than 80W, use your Sankey diagram above and any other description of energy transformations in this investigation to: Explain why your wind turbine produced less than 80W.

4. Discuss why research into renewable sources of energy (like wind and solar) is important.

Below is a summary of the physical principles and formulas studied in this unit that may help you carry out this assessment:

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|---|---|
| Energy is always conserved. It cannot be created or destroyed. | No system transforms energy with 100% efficiency. There is always some waste. |
| $P = I \times V$ | $P = E / t$ |

# Criteria of Assessment

| **Criteria** | **Mark** |
|---|---|
| Participation<br>Active participation in group work, setting up apparatus, collecting data, etc. | /2 |
| Data Collection<br>All raw data (i.e. voltage and current) is shown for each turbine configuration, and the units are expressed correctly (i.e. V, mA etc.). Each configuration is also described clearly (i.e. which type of blades, how many blades, their arrangement etc.) | /4 |
| Power Calculation<br>Power for each configuration is calculated correctly, and units expressed correctly (i.e. W, mW etc.) | /2 |
| Diagram<br>A labelled diagram showing the set up of the equipment you used | /2 |
| Method<br>A clear written description of how you performed your investigation. This should include how you used the equipment available (voltmeter, ammeter, etc.), a discussion of any problems you encountered and how you overcame them, a description of how you collected and analysed your data (use of averages, rejection of very high or low data points etc.), a description of who in the group did what, and any other important procedures in your investigation. | /4 |
| Conclusion<br>A clear conclusion in response to the aim of the investigation is stated and accords with the data collected | /1 |
| Discussion Questions<br>Full and detailed answers for all questions. | /8 |
| Presentation<br>Clear, neat report, with title and headings, correct spelling, grammar, punctuation, labelled diagrams, clear table of data, working shown for calculation, etc. | /7 |
| Total | /30 |