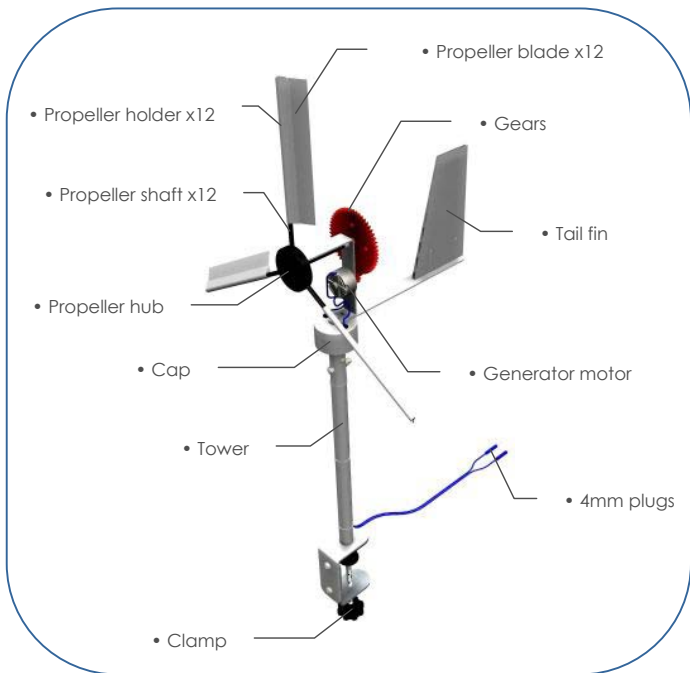
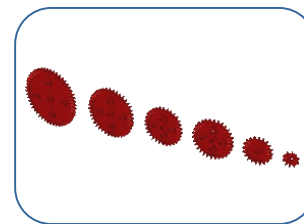


# Wind Turbine Kit

## What's in the box?



- Bench voltmeter + instructions
- Motor module box
- LED module box
- Buzzer module box



- 50-tooth gear x1
- 40-tooth gear x1
- 30-tooth gear x 2
- 20-tooth gear x1
- 10-tooth gear x1



- Activity sheets 1-3
- Propeller assembly instructions
- Care and maintenance sheet
- Spares and repairs sheet
- Feedback questionnaire



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## Wind Turbine Kit

### Care and maintenance

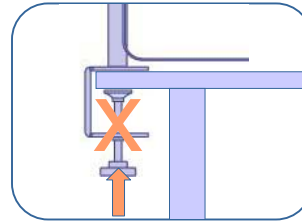
! The wind turbine kit has been specifically designed for use in a classroom environment.

However, the design of the turbine and module boxes have components exposed in order to demonstrate its operation. This means that there is potential for damage if the unit is abused, in particular to exposed wires.

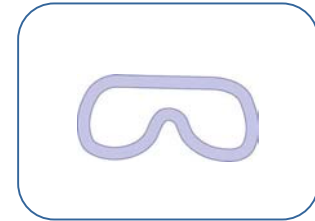
Following these guidelines will help prolong the life of the turbine, while giving best operating results:



\* Do not allow the turbine to get wet. This could cause corrosion to the electrical contacts or damage to the generator.



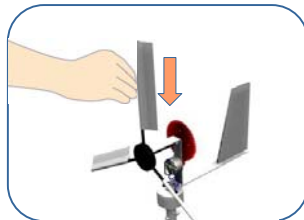
\* Do not overtighten the clamp. This could distort the metalwork and may make it difficult to undo the clamp after use.



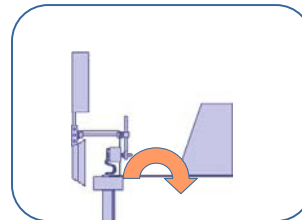
✓ Safety goggles must be worn at all times.



✓ Regularly apply a moisture-dispersing lubricant to the contacts in the nacelle and tower.



✓ Ensure that the propeller shafts are pushed firmly into the hub, otherwise they may fly out.



✓ If the tail becomes bent, it can be straightened by hand.



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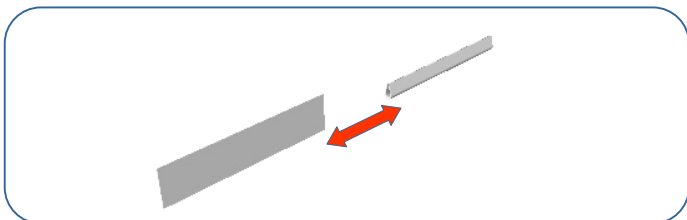
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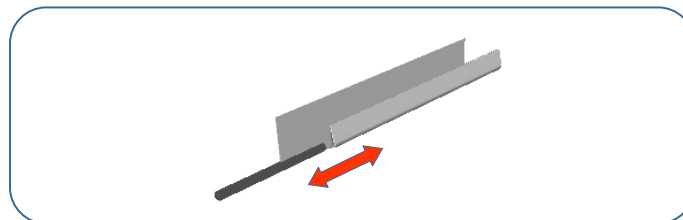
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## Wind Turbine Kit

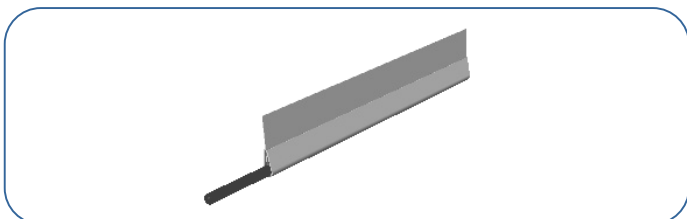
### Propeller assembly instructions



1. Take the card propeller blade and slide it into the propeller blade holder, leaving about 4cm remaining outside.



2. Take a black propeller shaft and carefully slide it in with the card propeller blade until the card is fully inside the propeller blade holder. Be careful not to tear the card blade. The propeller shaft should protrude by about 3-4cm.



3. Your propeller blade is ready for use! If you need to replace a blade, simply cut out a new one from a piece of card (15cm x 3cm). You can also experiment with different shapes and sizes of blades.

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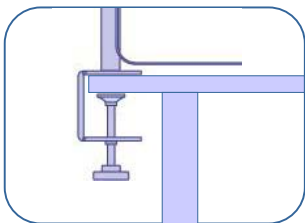
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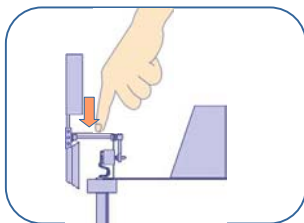
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## Wind Turbine Kit

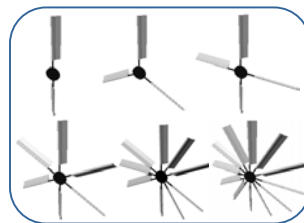
### Activity 1 - Setting up



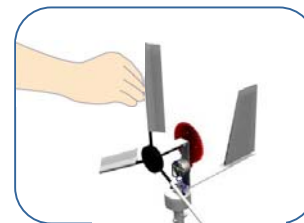
1. Decide on a suitable surface such as a table that isn't going to be damaged by the clamp. Take the tower out of the box, and clamp it to the edge of the surface.



2. Put the nacelle on top of the tower. Push down firmly above the centre of the cap to make sure the contacts are touching the top of the tower (check by looking through the cap).



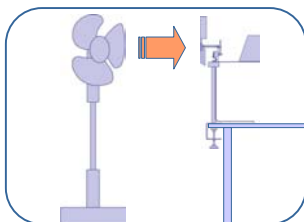
3. Decide how many blades you are going to fit to the turbine. The blades **must** be evenly balanced, or you may damage the turbine, so choose from 2, 3, 4, 6, 9 or 12 blades.



4. Firmly push the shafts into the correct sockets in the hub, angling each blade at about 45°. Use your finger to gently turn the blades round, checking that the hub rotates smoothly.



5. If you want to add one of the module boxes or a meter, connect it now.



6. Set up a desk fan approximately 50cm away from the wind turbine. Make sure the centre of the fan is level with the centre propeller hub. Alternatively take the kit outdoors to use real wind power!



7. Your wind turbine is ready for use!



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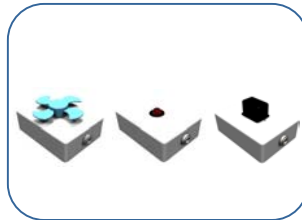
## Wind Turbine Kit

### Activity 2 - What can the turbine do?

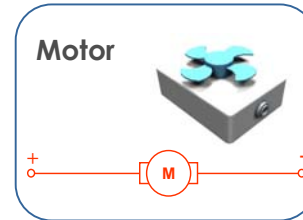
① The polarity of the current generated by the wind turbine is dependant on which way the hub rotates.

The LED and buzzer modules are polarity-dependent. If at first they fail to operate, reverse the plugs and try again.

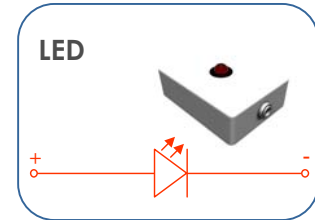
The motor module will operate regardless of polarity, but the direction in which it spins will depend on the rotational direction of the generator motor.



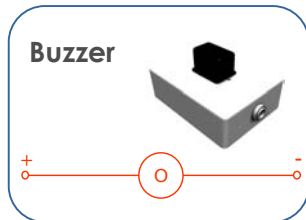
1. Connect the turbine to each module box in turn. Make sure you have made a complete circuit.



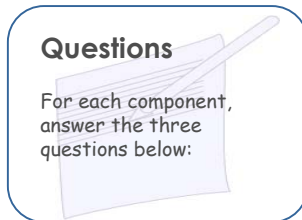
2. The blue propeller on the motor module box will rotate. The faster the generator motor rotates, the faster the propeller will spin.



3. The red LED (light-emitting diode) on the LED module box will illuminate. The faster the generator motor rotates, the brighter the LED will become.



4. The buzzer on the buzzer module box will sound. The faster the generator motor rotates, the greater the pitch/volume of the buzzer.



- (i) What happens?
- (ii) How could this be useful in real life?
- (iii) Describe how energy is transferred within the circuit, e.g. the wind energy makes the turbine turn.



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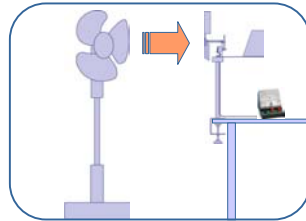
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## Wind Turbine Kit

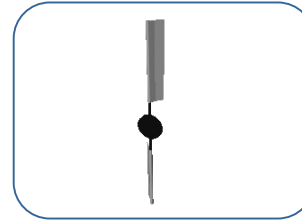
### Activity 3 - Number of blades

You are going to measure the voltage produced by the turbine with different numbers of blades, ranging from 2 blades up to 12 blades.

Before you start, predict which number of blades will give the highest reading on the voltmeter. If you can, try to give a reason for your prediction.



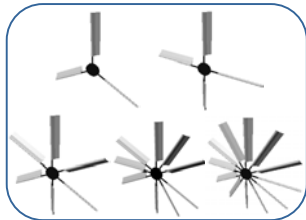
1. Set up the turbine and connect it to a voltmeter, with a fan a measured distance away.



2. Put 2 blades on opposite sides of the hub so that they balance. Make sure they are twisted the same way, and by the same amount.



3. Measure the highest voltage produced by the turbine when you switch the fan on. Draw a table to let you write down the number of blades and the voltage.



4. Repeat steps 1, 2 and 3 with 3 blades, 4 blades, 6 blades, 9 blades and 12 blades.



5. Draw a scatter graph of your results.



#### Questions

Use your bar chart to answer these questions:

- (i) How many blades give the highest voltage?
- (ii) Is this what you predicted?
- (iii) Try to explain why your results agree (or disagree) with your prediction. What might be going on?



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