Wind Turbine Building Instructions

Items included:

Quantity	Item	Item Label	Included Yes/No
1	Base Plate	A	
1	Base Rod	B	
3	Rotor Blade	C	
1	Rotor Hub	D	
1	Nose Cone	E	
1	Motor in Square Frame	F	
1	Square Frame	G	
2	3-Hole Dual Rod w/ Anchor Pin	H	
1	3-Hole Cross Rod	I	
1	Small Pulley	J	
2	Blue Gear Wheel	K	
1	LED Cover	L	
4	Button Pin	M	
6	Red Anchor Pin	N	
5	Blue Anchor Pin	O	
1	Red Joint Pin	P	
1	XL Black Axel	Q	
1	White Axel	R	

Procedure:

Use Figure 1 for steps 1-3.

1. Place red anchor pins on the corners at one of the ends of the base rod.
2. Align bottom of base rod with the center of the base plate. Push red anchor pins firmly to secure base rod to base plate.
3. Set assembled base aside.

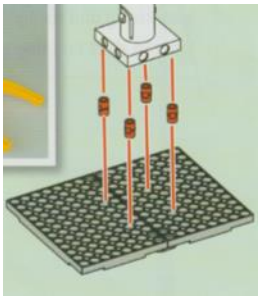


Figure 1: Base Assembly

Use Figure 2 & 3 for steps 4-6.

4. Place rotor blades on the pins of the rotor hub leaving one pin between each blade, as shown in figure 2.
5. Attach assembled blades into the nose cone as shown in figure 3.
6. Set assembled rotor aside.

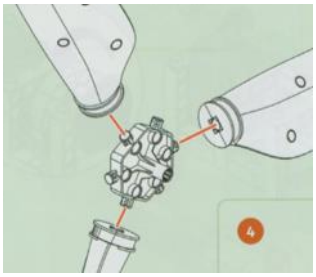


Figure 2: Blade Assembly

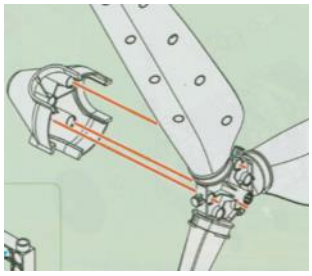


Figure 3: Rotor Assembly

Use Figure 4 for steps 7-10.

7. Attach pin of part H to the bottom left corner of the motor frame. Attach red anchor pin to the free end of part H.
8. Attach blue anchor pin to the bottom-right corner of motor frame. Attach part H to the blue pin.
9. Insert red anchor pin into top left corner of motor frame. Place one end of part I on the red pin. Place red joint pin into free end of part I.
10. Align square frame with pins and press firmly to secure into place.

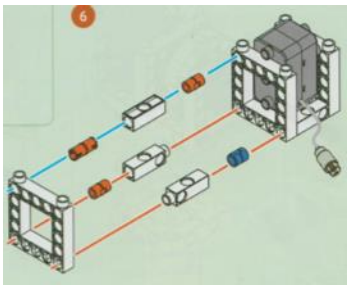


Figure 4: Motor Block Assembly

Use Figure 5 for steps 11-14.

11. Attach small pulley into the available hole at the top left side of the motor block.
12. Rotate the pulley into the block as far as it will go. Do not apply too much force.
13. Slide the black axel through the middle hole at the top of the motor block. Push it all the way into the motor.
14. Slide a blue gear onto the free end of the axel. Push all the way back.

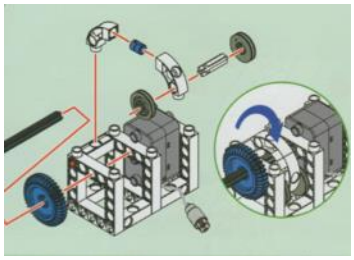


Figure 5: Gear Assembly

Use Figure 6 for steps 15-16.

15. On back side of motor block, slide long end of white axle into the middle hole at the top of the motor block.
16. Attach blue gear wheel into the short end of white axle.

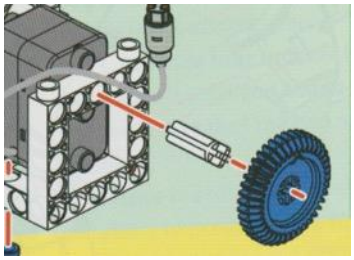


Figure 6: Gear Assembly Cont.

Use Figure 7 for steps 17-19.

17. Place the remaining blue anchor pins on the corners at the top of the assembled base.
18. Align the bottom of the motor box with the top of the base. (You can rotate the rods along the bottom as needed).
19. Press motor box firmly onto the base to secure it in place.

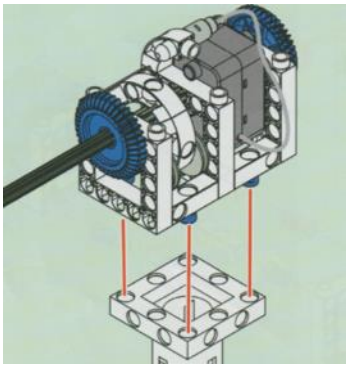


Figure 7: Turbine Assembly

Use Figure 8 for steps 20-22.

20. Align holes at the bottom of the LED cover with the bottom side of the motor box.
21. Secure LED into place with button pins.
22. Do so on both sides of the motor box.

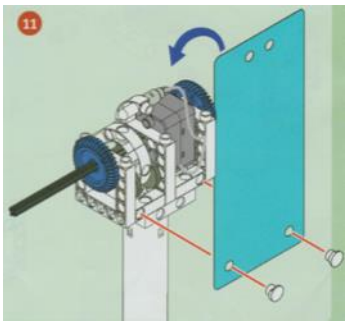


Figure 8: Turbine Assembly

Use Figure 9 for steps 23-24.

23. Slide assembled rotor on to the free end of the black axel. Push firmly to secure into place.
24. Give a good spin to make sure it works!!

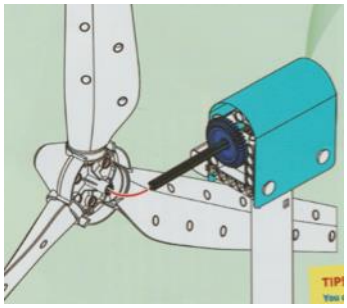
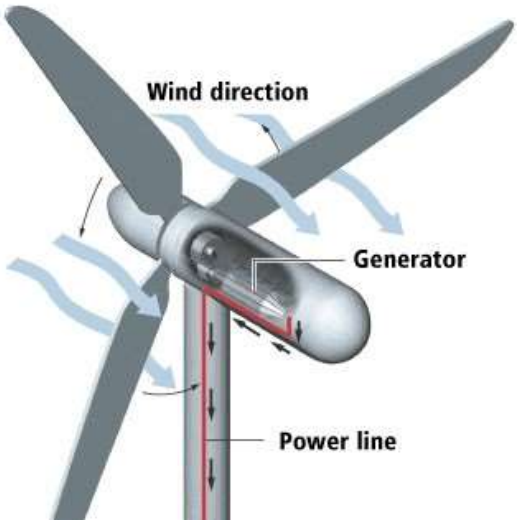


Figure 9: Turbine Assembly Cont.

Wind Energy Exercise



In this activity, you will measure the Kinetic Energy into the wind turbine and power produced by the wind turbine.

Remember:

1. This is a team project
2. Take proper care of the materials provided
3. Ask questions
4. Have fun ☺

❖ Check that the wind turbine works properly. Spin the turbine, does the LED light up?

➢ Why does the LED light up only when spun in one direction?

❖ If the air velocity is 6 m/s and flow is 3.7 kg/s how much Kinetic Energy is going into the wind turbine? Show your calculation below:

- What type of energy is coming out of the system?

- How much energy is coming out? Using the voltmeter find the Voltage and Current that the turbine produces. How much power is produced? Remember Power = Voltage x Current

- Compare the energy in and the energy out of the system. Which one is bigger?

- Why is it that one of the energies is bigger than the other? Where did the energy difference go?

Formula Sheet

KINETIC ENERGY:

$$KE = \frac{1}{2}\dot{m}v^2$$

POTENTIAL ENERGY:

$$PE = \dot{m}gz$$

EFFICIENCY:

$$n = \frac{Energy\ Output}{Energy\ Input}$$

POWER:

$$P = I * V$$

$$P = A_S * P_{sun}$$

WORK:

$$W = F * d$$

FORCE:

$$F = m * a$$

ACCELERATION:

$$a = \frac{v}{t}$$

VELOCITY:

$$v = \frac{d}{t}$$

COMPONENTS

v= velocity

$\dot{m} = mass\ flow\ rate$

g= gravity

z= height

n=efficiency

I= current

V= voltage

$A_s = solar\ panel\ area$

$P_{sun} = power\ produced\ by\ the\ su$

ρ= density

$\dot{V} = volumetric\ flow\ rate$

$A_c = crossectional\ area$

d= distance

a= acceleration

m= mass