Energy & Power Lab Wind Pump 2.0

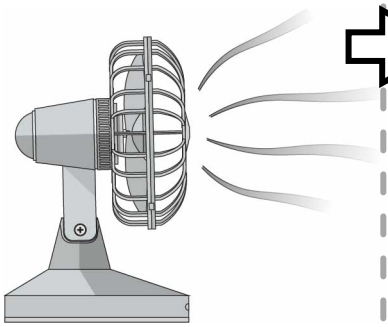
Name:_____ Period:_____

Date:_____

How powerful is your turbine? Time to find out!

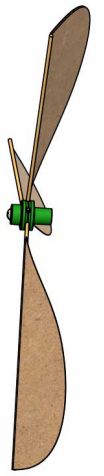
Your Wind Pump converts Wind Energy into Potential Energy.
The faster your pump can convert energy, the more powerful it is!

Wind Energy



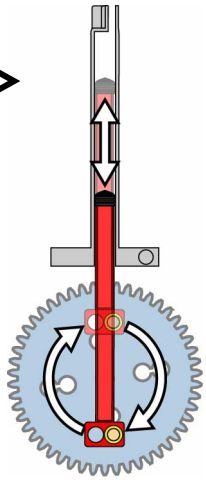
Energy of the wind's motion.

Mechanical Energy



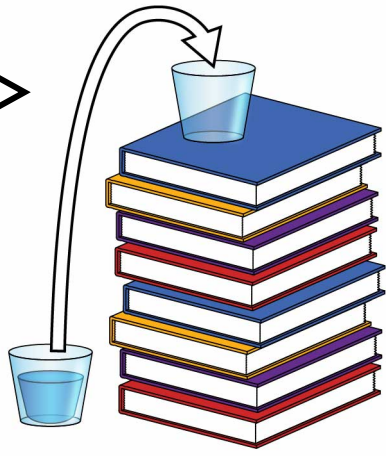
Energy of the spinning rotor.

Mechanical Energy



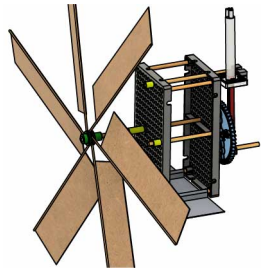
Energy of the gears' and cylinder's motion.

Potential Energy



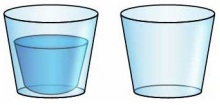
Energy stored in gravity when water is pumped to a greater height.

Lab Supplies



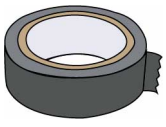
"Built" Wind Pump

Fan



2 Cups
(one filled with water)

Stopwatch



Duct Tape

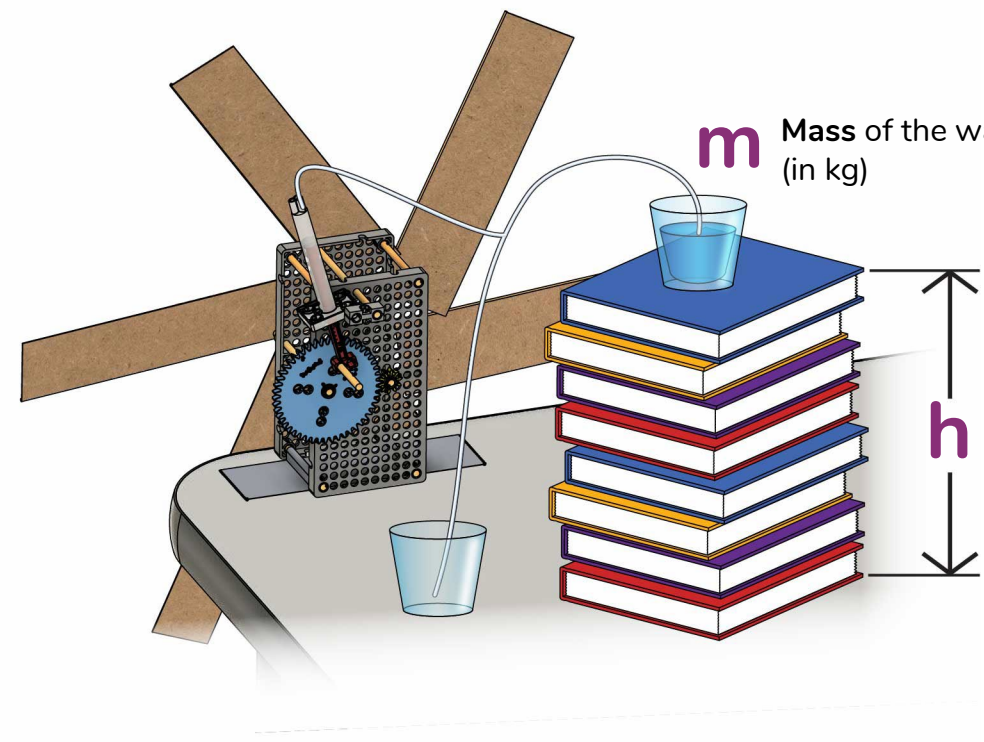
Scale
(to measure mass of water)

Books

Build your Wind Pump using the Go Guide.
Download it at teachergeek.com/windpump

Calculate your pump's energy and power!

The change in the water's potential energy can be found by multiplying m ∗ g ∗ h .



m **Mass** of the water (in kg)

g Acceleration due to **gravity** (9.8 m/s^2)

h **Height** the water is pumped upward (in m)

+ Height is positive when water is pumped upward

− Height is negative when water is pumped downward

1. Calculate the change in potential energy of the water when its pumped from the lower cup to the upper cup (you'll need to measure m & h).

Change in Potential Energy → $E = m\ g\ h$

2. Time your turbine pumping the water from the lower cup to the upper cup, then calculate the power it produced.

Power → $P = E / t$ ← Time to pump the water

What happens if you pump downwards?

3. Calculate the change in potential energy of the water when it's pumped downwards – from the upper cup to the lower cup.

$$E = m\ g\ h$$

4. The energy you calculated in #3 should have been negative (because height is negative). If the water lost its potential energy, where do you think it went?

5. Time your turbine pumping the water from the upper cup to the lower cup, then calculate the power it produced.

$$P = E / t$$

6. Does your pump go faster when pumping the water upwards or downwards?

How much power can your pump generate?

7 Test pumping water upward to 4 different heights. At what height does your wind pump develop the greatest power?

Recommended Heights:
40 cm, 30 cm, 20 cm, 10 cm

8 If a AA battery can store about 5000 J of energy, how long would it take your wind pump to charge the battery?

Optional

Power Challenge

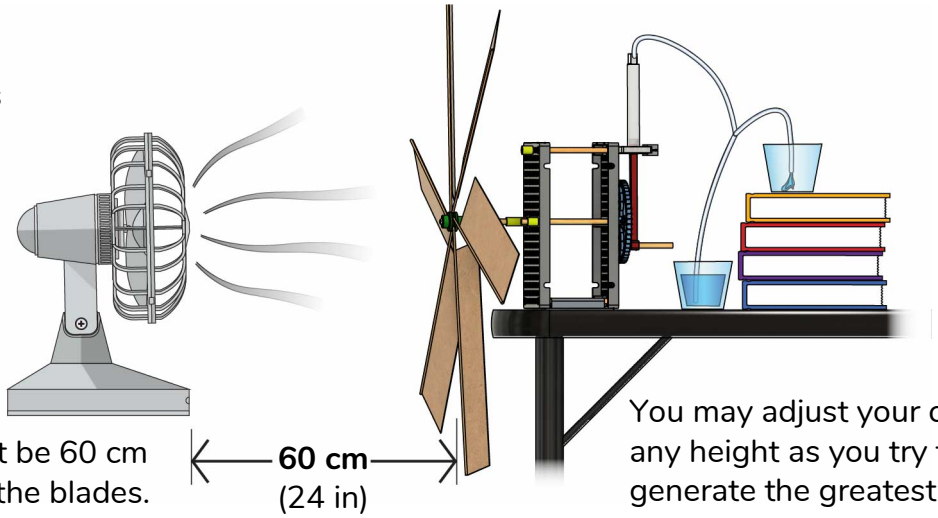
Redesign your wind pump to create as much power as possible!

Criteria:

The pump that generates the greatest power wins!

Constraints:

Only wind can power your pump (but you can give it one small push to get it started).



The fan must be 60 cm (24 in) from the blades.

You may adjust your cups to any height as you try to generate the greatest power.