

WIND POWER AND THE GENERATION OF ELECTRICITY

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Teacher: S. Mitson (D. Wyatt was involved in preliminary development stages)

Curriculum Expectations:

E2.5 compare, on the basis of observation, the differences between series and parallel circuits

E2.6 use an inquiry process to investigate the effects that changing resistance and changing potential difference have on current in a simple series circuit

E3.3 identify the components of a simple direct current (DC) electrical circuit (e.g., electrical source, electrical load, switch, fuse), and describe their functions

Learning Goal: To make a simple motor and wind turbine that will produce an electric current when exposed to wind.

Technology:

- Make a wind turbine USED to capture wind energy and transfer to spin a generator
- Making a simple A.C. generator that produces an electric current

Engineering:

- Fitting and refitting components together
- Use and engineering design process to design, build, test, modify and rebuild and retest a technology (wind turbine and generator)

Mathematics:

- Geometry: Blade angles: measurement using a protractor, determine angle based on number of blades
- Measuring length and width of structures and wires
- Graphing: Graphical representation of data, analysis (relationship between variables) - all graphing skills (scale, type, etc.)
- solving equations and relationships among variables

Success Criteria: *How will you know if students are achieving the learning goal?*

- Wind turbine blades freely turn the axle and provide a smooth turning motion of the magnets within a coil of wire
- A noticeable current is produced
- Students follow an engineering design process
- Students use sound reasoning to assess their design
- Product shows good knowledge of and understanding of the components of a generator and principles of electric circuits.
- Students use criteria in constructing and modifying wind turbines and generators.
- Students use observations, criteria, and sound reasoning skills when assessing and revising their designs.
- Students use strategies for working well in teams (capitalize on individual strengths, encourage each other, open to constructive feedback, readily assume various roles, etc.)

Assessment: *Formative, Summative, Combination? Observation, Conversation, Product?*

- *Observation of the problem solving capabilities of the students*
- *How well the wind turbine spins*
- *The ability of the wind turbine to produce a measureable current.*
- *Use of sound criteria in designing and redesigning.*

Background Knowledge/ Prior Learning:

Review circuits and current

Discuss clean energy alternatives

Discuss how a wind turbine works (see video suggestions in Pre-Lab handout)

Minds On: *Think about ideas, brainstorm strategies, ask questions...*

Materials/Logistics/Resources:

Have students, in small groups, co-construct characteristics of a successful wind turbine and share with the class. (See sample **T-chart Activity** for co-constructing criteria)

Combine criteria and, as a class, determine the 3 most important characteristics of a successful wind turbine.

Display the materials and suggest some possible uses for some of them.

Give an overview of the task (see **Wind Turbine Lab handout**).

Show a **You-tube video** to illustrate the task.

Encourage students to use their own ideas (see **Pre-Lab handout**)

Action: *Solve problems, choose methods, strategies and concrete materials, develop perseverance...*

Students will have a set amount of time to plan out a design.

They will then show the teacher the design along with their rationale

They will choose the materials based on their design criteria

They will build their design and solve design problems as they arise

They will test the design and make any alterations needed before they display it to the class.

- Epoxy coated wire 0.2 - 0.5 mm 18ft per group
greater voltage is achieved with thinner wire ex 0.2 it is much more cost efficient as well (Ebay)
- Rare earth magnets 10mm X 3mm 4 per group
- BBQ Skewers for blades (Dollarama)
- Wood dowels for drive shafts (Dollarama) same size as skewers but straighter and truer.
- coat hangers for drive shafts
- straws for bushings for dowels or coat hanger drive shafts
- Styrofoam balls medium and larger
- corks
- plastic water bottles
- compass for checking polarity of magnets
- tape
- hot glue guns and glue
- multi meter that can read millivolts (200m setting)
- sandpaper
- scissors
- drill bits
- Exacto knife (optional)

Consolidate: *Sharing of solutions (e.g., gallery walk), reflections, critiques...*

At the end of the activity have each group present their design and demonstrate the working model to the class.

A class discussion ensues to evaluate and discuss the various designs with a question and answer period as to why they choose the materials and design that they did.







(mailto:
subject
out



(http://www.rosalind.info/problems/1/)

RESOURCES

-  This lesson is from Works and can be given anytime before the Wind turbine lab assignment (https://connex.stao.ca/sites/default/files/engineering_lesson_support_from_works.pdf)
-  Pre lab assignment to be given one to two days before the main lab (https://connex.stao.ca/sites/default/files/pre_lab_for_wind_turbine_project.pdf)
-  This is the main lab depending on the level of the class you could omit the data collection charts and have them create them (https://connex.stao.ca/sites/default/files/wind_turbine_main_lab_assignment_2017.pdf)
-  Here is a current list of the main parts Wire and Magnets should be ordered well in advance of the lab (https://connex.stao.ca/sites/default/files/wind_turbine_supply_list.pdf)

ELEMENT

- Inquiry (/expert-elements/inquiry)

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