

## MULTI-TALENTED ELECTRICAL ENERGY

### Performance Standard 12C/11B.E

Students will apply the processes of technological design to explore energy conversions accordingly:

- *Knowledge*: Define and describe the basics of electrical energy and its possible conversions to other energy forms.
- *Application*: Demonstrate how electrical energy can be converted to light, heat, sound and magnetic energy.
- *Communication*: Explain how the energy is conserved in its transformation to other forms of energy.

### Procedures

1. ***In order to know and apply concepts that describe properties of matter and energy and the interactions between them (12C) and know and apply the concepts, principles, and processes of technological design (11B)***, students should experience sufficient learning opportunities to develop the following:
  - Brainstorm technological designs associated with ordinary examples where electrical energy (from batteries) is converted to other forms of energy.
  - Research sources of scientific information related to forms of energy, specifically electricity.
  - Suggest appropriate materials, equipment and data-collection strategies, procedural sequence, success criteria and design options to safely test the conversion of electrical energy to other forms.
  - Sketch design plan and select appropriate graphic display of data according to success criteria variables.
  - Complete assembly of innovation, following classroom rules for preparation, procedures and clean-up.
  - Collect and display data from investigation accurately and honestly.
  - Test prototype of design by conducting multiple trials and record observations,
  - Use scientific technologies to collect, store, retrieve, and communicate data, and incorporate appropriate safety precautions.
  - Communicate an evaluation report to explain the design, observations and explanations of tested energy conversions.
  - Generate future design modifications and alternative applications for design.

Note to teacher: This activity relates to knowledge associated with standard 12C, while addressing the performance descriptors for stage E within standard 11B and 13A.

2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. The premise of the technological design investigation is to create one or more simple devices which convert electrical energy from batteries to heat, light, sound and magnetic energy to accomplish simple “errands”. This can take the form of the Annual Multi-Talented Electricity Contest. The contest could determine simple errands such as melting an ice cube or lighting up a dark cube, or sounding as an alarm clock for a mouse or picking up iron nails. Provide each student a copy of the “Multi-talented Electricity” task sheet, which outlines the steps for their design process. Students could suggest (or the teacher may pre-determine) the goals of the devices, the criteria for a competition between designs for greatest success, time elements for designing, testing and competing or presentation strategies.
4. Students may work in small groups to conduct the investigation but must complete the task sheet independently.
5. Evaluate each student’s work using the Science Rubric as follows and add the scores to determine the performance level:
  - *Knowledge*: The definitions and descriptions for the basics of electricity and its conversions to other forms are complete and correct.
  - *Application*: The designs for each conversion are correct and operable (and creative).
  - *Communication*: The explanations were well-reasoned, well-detailed, and reflected the required knowledge and application processes.

**Examples of Student Work not available**

**Time Requirements**

- One class period for introduction and initial design planning; 2 class periods for construction and prototype testing; 1 class period for presentation and design competition.

**Resources**

- Copies of the “Multi-talented Electricity” task sheet
- Variety of batteries, insulated and bare wires, small bulbs, etc.
- Science Rubric

# MULTI-TALENTED ELECTRICITY DESIGN COMPETITION WORKSHEET

Your assignment is to create a simple device which can do one of the following tasks:

- convert electricity to heat,
- convert electricity to light,
- convert electricity to sound,
- convert electricity to magnetism.

This is a competition and these are the rules (design parameters):

- You can only use (what materials?).
- It must only measure (how big?).
- It must work for (how long?).
- It must be able to (do what?).
- It must be safe.

What else?

## MULTI-TALENTED ELECTRICITY DESIGNER'S JOURNAL

You must record the steps of your technological design process in your journal.

**STEP ONE: Figure out the design**

Brainstorm ideas for creating talented electricity:

List your possible ideas:

**STEP TWO: Find resources**

Research sources of scientific information about electricity and its kinds of conversions and record your information on a separate sheet of paper.

Where can you look?

Which resources did you use?

What facts do you need to learn in order to use the properties of electricity?

**STEP THREE: Make plans**

What data can you collect about your design's success and how will you collect it? (What are the variables in this experiment?)

What is your procedure? (List your steps in order)

What are the safety concerns?

What is the clean-up procedure?

Sketch your design plan.

**CONSTRUCT YOUR DESIGN** (follow all safety guidelines)

**TEST YOUR PROTOTYPE** (multiple trials)

**COLLECT YOUR DATA** (on your data table)

**BEGIN THE ANNUAL MULTI-TALENTED ELECTRICITY COMPETITION**

What works the best (based on which criteria)?

What improvements can you suggest (for another design or the process)?