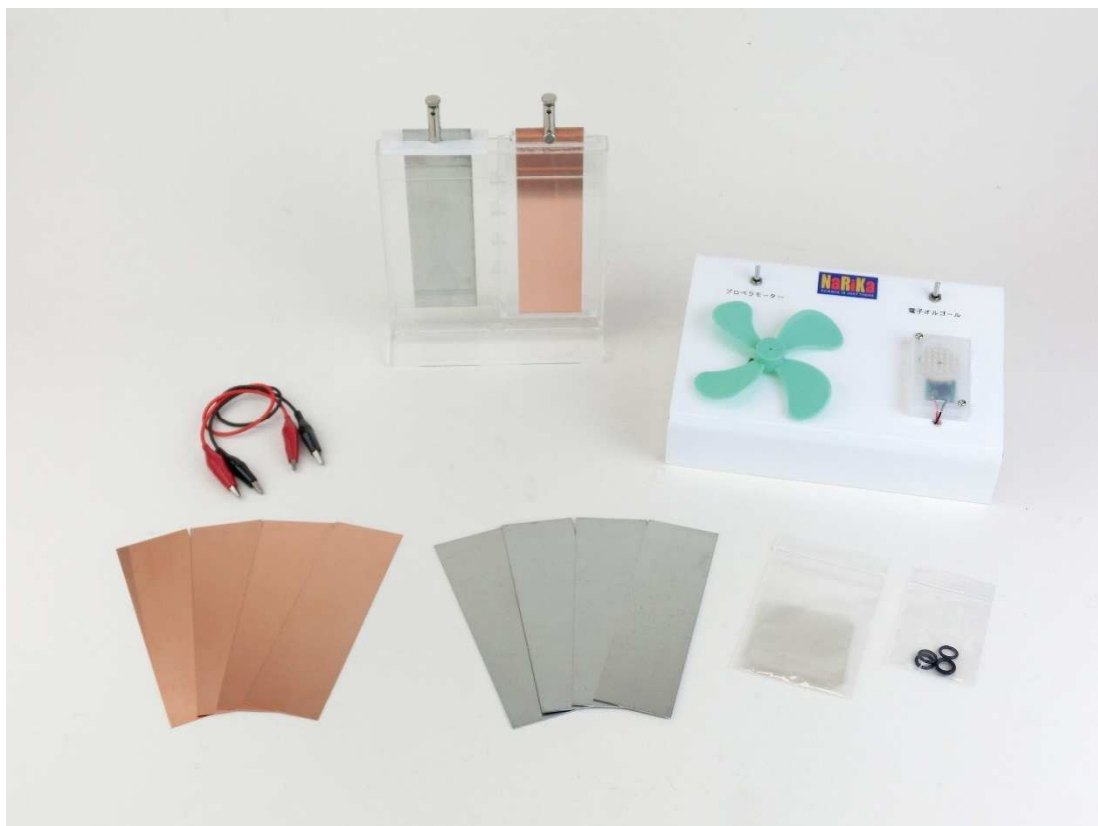


Large Daniell Cell for Demonstration

Cat. No. B10-2003-W0



March 2023

Safety Precautions

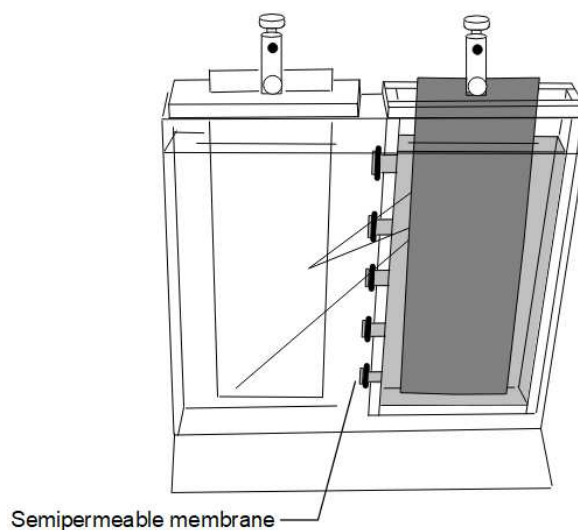
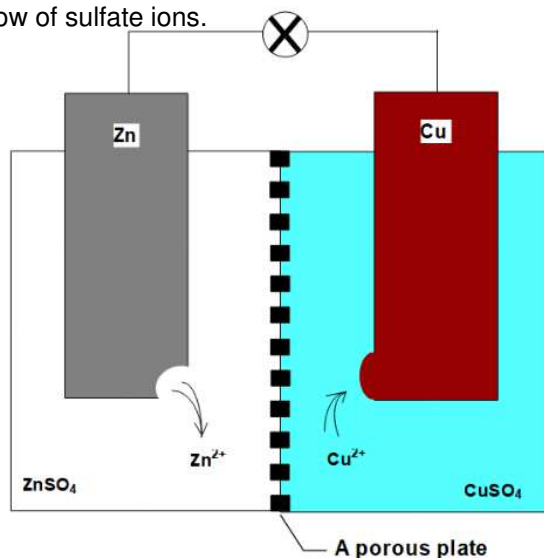
- **Wear safety glasses and safety gloves when you do experiments with this product.**
- **Read carefully about the operating procedure and the safe ways of conducting experiments with this product prior to experiments.**
- **Be careful with chemicals. Wash thoroughly with a large amount of water immediately if it enters one eye and/or adheres to the body.**
- **Always prepare and demonstrate in a plastic tray to protect yourselves and your surroundings from the chemicals used.**
- **Thoroughly read the Safety Data Sheet (SDS) of copper sulfate and zinc sulfate in advance for safety.**
- **Do not disassemble, repair, or remodel this product. This product might not properly work, you might hurt yourself and the warranty will be void.**

Introduction

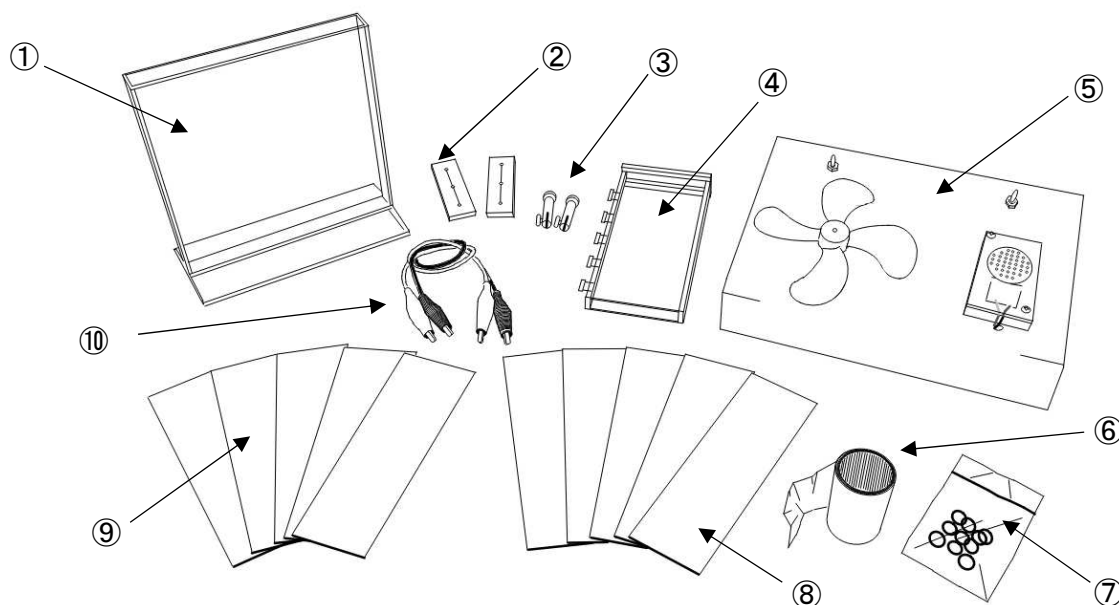
Product's Feature

The product resembles figures, diagrams, or pictures of Daniell Cell, which commonly appear in science textbooks/guidebooks or on relevant websites. Thus, demonstrations using this product will most likely match the practices typically illustrated in such teaching materials.

The reaction tanks are designed to have a large surface area for better observation of the reaction and a minimal thickness for a smaller amount of used chemicals. This product consists of two components: a "Daniell Cell" and a "Built-in electric melody and propeller motor module". The "Daniell Cell" includes a larger reaction tank to contain zinc sulfate solution and Zinc metal plate for the oxidation reaction, while a smaller one to contain copper sulfate solution and Copper metal plate for the reduction reaction. The monolithically designed smaller tank has five tubelike holes. They will be functionally equivalent to porous plates, conventionally used as the separator between zinc solution and copper sulfate solution, by being covered with (see drawing below with visualization of the chemical reaction) semipermeable membrane films that allow the flow of sulfate ions.



Contents



- ① Larger reaction tank for zinc sulfate solution : 1 pc ② Electrode holder: 2 pcs ③ Terminal: 2 pcs
 ④ Smaller reaction tank for copper sulfate solution: 1 pc
 ⑤ Built-in electric melody and propeller motor module for teachers' demonstration: 1 pc
 ⑥ Rolled semipermeable membrane tube: 1m ⑦ O-ring: 10 pcs ⑧ Zinc metal plate: 5 pcs
 ⑨ Copper metal plate: 5 pcs ⑩ Lead with clips (red & black): 1 pc each

How to use

Preparation

1. Prepare chemicals for the demonstration

Prepare zinc sulfate and copper sulfate solution beforehand as they are not included in this product. Recommended concentrations of zinc sulfate solution and copper sulfate solution are 1 – 7% and 5 – 14% respectively. Prepare 60 mL of copper sulfate solution and 180 mL of zinc sulfate solution for the demonstration.

Zinc sulfate solution: 1 – 7%: 180 mL

Copper sulfate solution 5 – 14%: 60 mL

2. What else is needed:

- *Safety goggle *Lab ware *Safety gloves *Scissors * Pipette
 *Plastic tray (recommended size A4, shallow type)

Setting up a Daniell Cell

[1] Prepare the smaller tank to contain copper sulfate solution.

1. Cut the rolled semipermeable membrane tube to a length of approximately 30 mm with scissors to prepare five small pieces of the sheet.
2. Soak the films in water.
3. Place the film on each flange of the hole.
4. Cover each of the tubelike holes with the film by fastening it with an O-ring. Make sure to reduce the wrinkling as much as possible (See Fig. 1, Fig. 2).

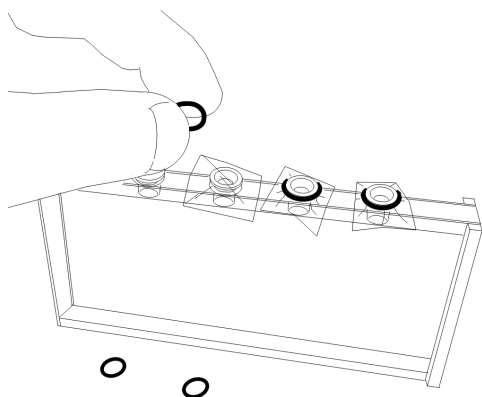


Fig. 1

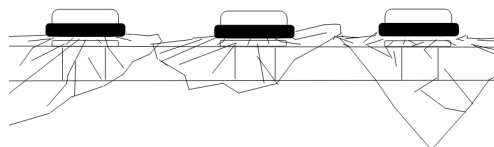


Fig. 2

[2] Check the flanges and holes for water leakage.

1. Pour some water (around 60 mL) from a beaker into the smaller tank (see Fig. 3).
2. Check if water leakage from the flange(s) and hole(s) occurs. If water leakage occurs, remove the film(s) from the flange(s) in question and repeat the procedure [1]. Note that wrinkling on the film(s) can cause leakage from the tank.

[3] Check if the smaller tank can be smoothly slid in and out of the larger tank (Fig. 4).

1. If you feel considerable resistance in sliding the smaller tank in and out of the larger tank, cut off the margin of the films, as appropriate, with scissors to reduce the sliding friction that occurs between the smaller tank and the larger one.

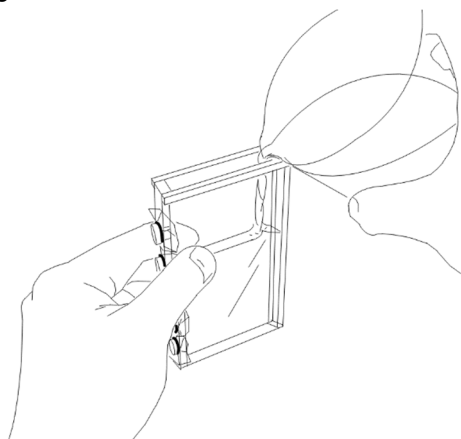


Fig. 3 Pouring water

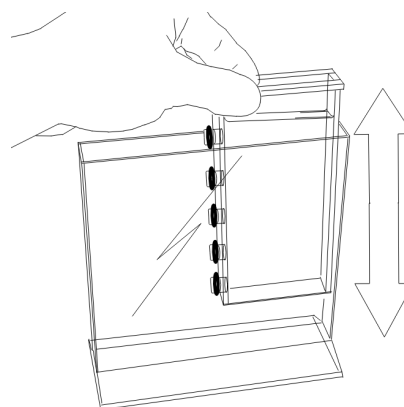


Fig. 4 Sliding smaller tank in/out

[4] Put electrolytes into the tanks.

1. Pour off water from the smaller tank.
2. Insert the smaller tank into the larger one, and then carefully pour copper sulfate solution into the smaller tank with a pipette or a dropper until all the five holes are fully submerged in the solution (Fig. 5). Using a plastic tray for this procedure is recommended for safety.
3. Check if there are no bubbles remaining in the holes. If any air bubble remains, clear it by sending some amount of copper sulfate solution into the holes with the pipette (Fig. 6).

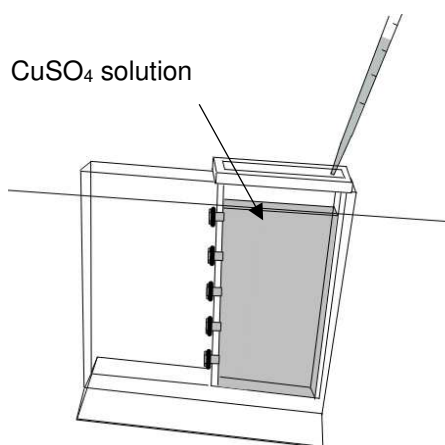


Fig. 5 Putting copper sulfate solution in tank

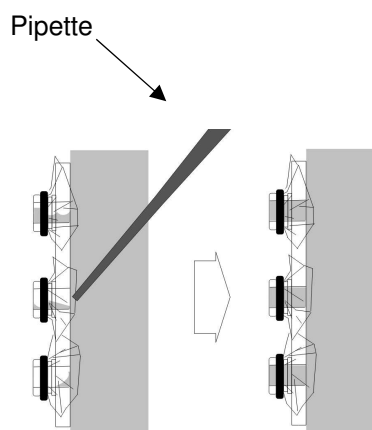


Fig. 6 Clearing air bubbles

4. Put the zinc sulfate solution (180 mL) carefully into the larger tank using another pipette or dropper until the solution surface lines up with the surface of the copper sulfate solution in the smaller tank (Fig. 7).

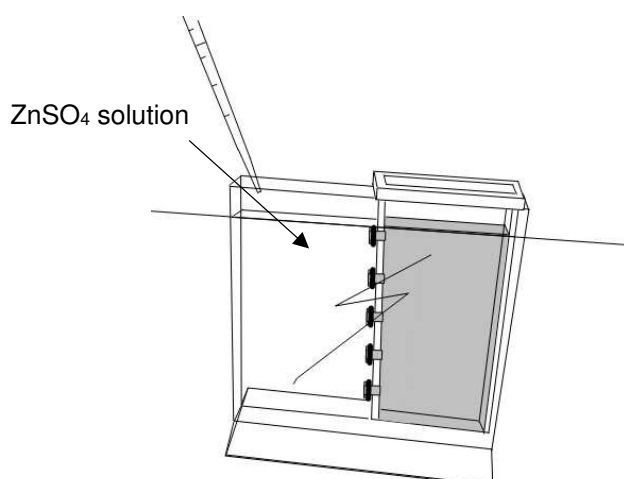


Fig. 7 Putting zinc sulfate solution in the larger tank

Put the copper sulfate solution into the smaller tank first. Then, put the zinc sulfate solution into the larger tank. If done the other way, the empty smaller tank would float in the larger one.

[5] Assemble the electrodes.

1. Insert each metal plate into each slot of the terminals and fasten them using the knuckled screws.
2. Insert the zinc electrode plate through the slit of an electrode holder until the electrode terminal on the plate touches the holder.

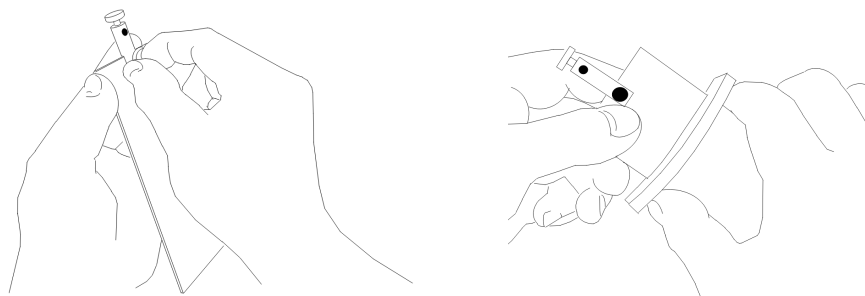


Fig. 8 Connect a copper metal plate to the terminal.

3. Insert the zinc electrode slowly and carefully in the larger tank until it can be suspended from the edge of the tank.
4. Insert the Copper electrode slowly and carefully in the smaller tank until electrode touches the bottom of the tank. No electrode holder is required.

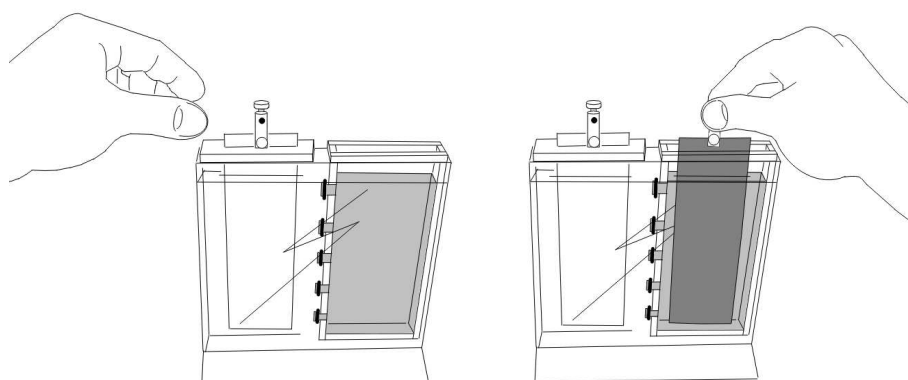


Fig. 9 Set two metal plates in the tanks.

[Tips:] Make sure the height of the solutions and metal plates are lined up for easier observation by students.

Demonstrating Power Generation

The module consists of a propeller with a motor and an electric melody unit. Simply designed to demonstrate how a Daniell Cell generates electric power that will eventually be converted to wind/sound energy.

Equipped with two switches that will independently power either of the propeller motor or the electric melody unit.

Connect the module to the Daniel Cell to operate either the propeller motor or the melody unit, but not both, due to the limited electric-generating capacity of the connected Daniell Cell.

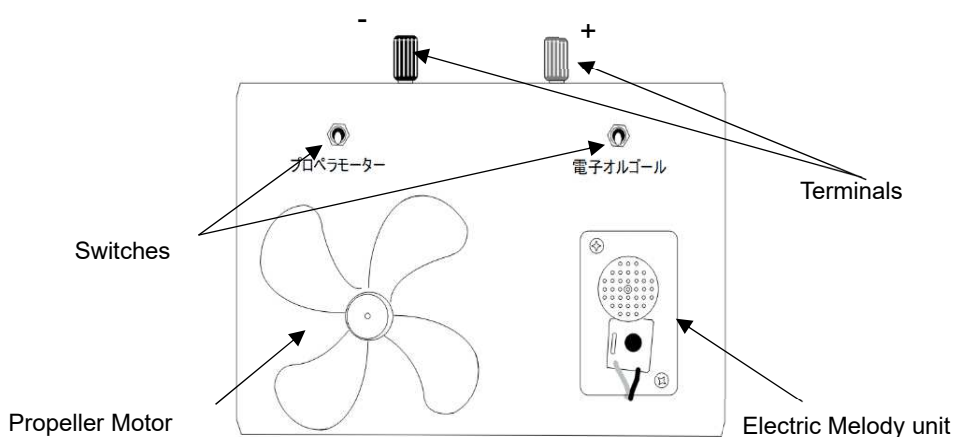


Fig. 10 Built-in electric melody and propeller motor module

1. Connect the terminal of the Zinc electrode to the black terminal of the module using the lead with the black clips. Likewise, connect the terminal of the Copper electrode to the red terminal of the module.
2. Power on the propeller motor by moving the toggle switch (close to the propeller) up. Make sure to power off the propeller motor before moving on to the next step shown below.
3. Power on the electric melody unit by moving the toggle switch (close to the unit) up. Make sure to power off the unit after demonstration.

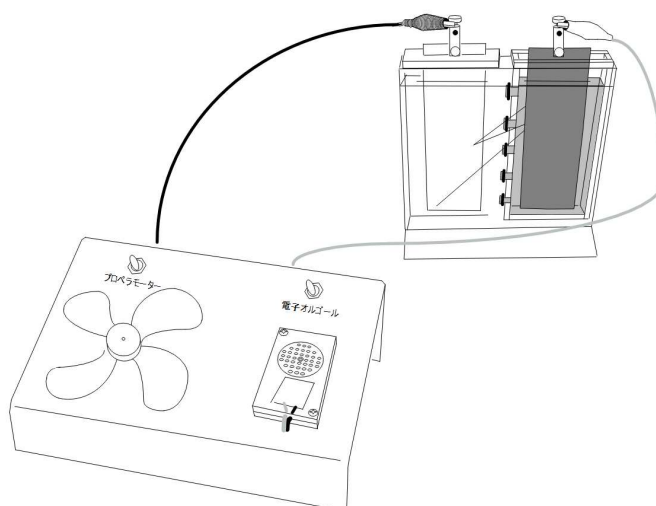


Fig. 11 Large Daniell Cell for demonstration in use

Maintenance

[1] Long-term storage

1. Remove both plates from the tanks. Wash those plates and keep them dry.
2. Drain each type of the electrolytes into a recovery container respectively.
2. Remove the O-rings and films from the smaller tank.
3. Wash the tanks with water and keep them dry.

Make sure nothing is left in the tanks to prevent the electrolyte(s) from precipitating and/or crystallizing that could eventually clog the tube-like holes of the smaller tank. If you run out of the film/tube purchase spare from Narika (F35-7935-02 Rolled semipermeable membrane tube).

[2] Used metal plates.

For reuse and/or storage, wash, dry, and then polish the plates immediately after the demonstration. Check them for cracks. If so, dispose of them in accordance with local regulations. You can purchase spare from Narika (B10-2050-01 and B10-2050-04) or ask your local distributor.

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