Large Daniell Cell for Demonstration

Cat. No. B10-2003-W0

Dec. 2022

Safety Precautions

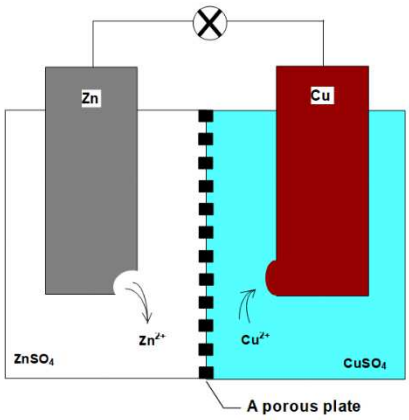
- **Wear safety glasses and safety gloves for a demonstration.**
- **Read carefully about the operating procedure and the safe ways of conducting experiments with this product prior to experiments.**
- **Keep away students from this demonstrator while the demonstration.**
- **Be careful with chemicals. Wash thoroughly with a large amount of water immediately if it enters one eye and/or adheres to the body.**
- **Conduct the demonstration in plastic trays 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 your safety.**
- **Do not disassemble, repair, or remodel this product. This product might not properly work, and the warranty will be void.**

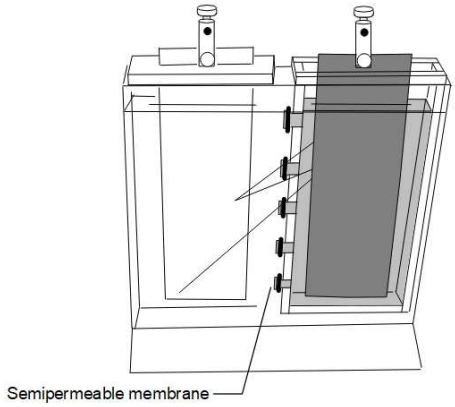
Introduction

Product's Feature

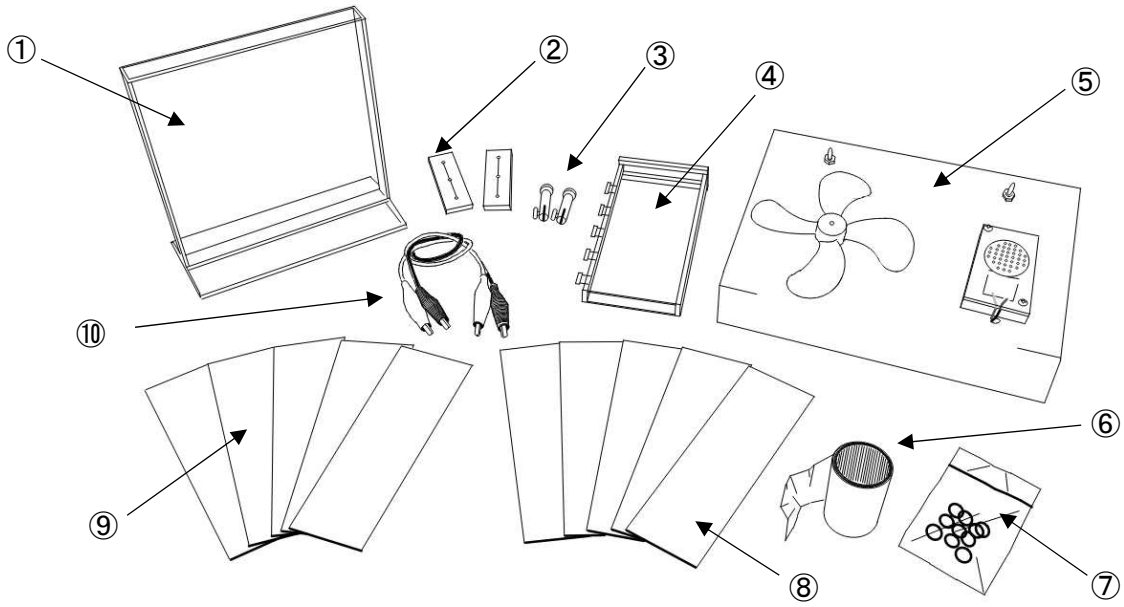
The product resembles figures, diagrams, or pictures of Daniell Cell, which commonly appear in science textbooks/guidebooks or on relevant websites. Thus, this product's demonstration will most likely match the explanation in textbooks of the Daniell Cell process.

This Large Daniell Cell consists of a large container for zinc sulfate solution for anode oxidation, a small container for copper sulfate solution for cathode reduction, a zinc electrode, a copper electrode, and each electrolyte. The small container has a unique structure with five holes covered by a semipermeable membrane and can slowly exchange ions.





Contents



① Container for zinc sulfate solution : 1 pc ② Electrode holder: 2 pcs ③ Terminal: 2 pcs
④ Container for copper sulfate solution: 1 pc
⑤ Accessory module with built-in electric melody and propeller motor: 1 pc
⑥ Semipermeable membrane tube: 1m ⑦ Rubber ring: 10 pcs ⑧ Zinc metal plate: 5 pcs
⑨ Copper metal plate: 5 pcs ⑩ Lead wire 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 because of no chemical solutions in this product. Adequate concentrations of zinc sulfate solution and copper sulfate solution are 1 ~ 7% and 5 ~ 14% each. 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 (dropper)
*Plastic tray (recommended size A4, shallow type)

How to assemble a Daniell Cell

[1] Assemble a small container for copper sulfate solution

1. Cut the semipermeable membrane tube to a length of approximately 30 mm with scissors.
2. Put the semipermeable films in water in a beaker and wet them.
3. Place the films on the flanges on the holes.
4. Place an O-ring on top of the films and press them to fix without wrinkles (see Fig.1, 2).

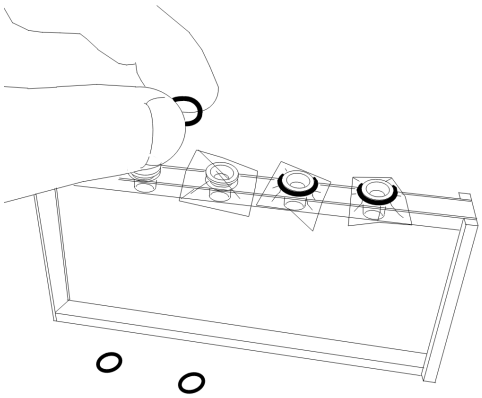


Fig.1

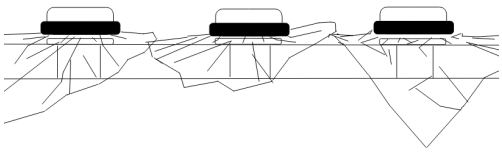


Fig.2

[2] Check water leaking from the holes and the flanges of the small container

1. Pour water from a beaker into the assembled small container (see Fig.3) Please use a plastic tray for safety.
2. After standing it for a while, check whether the small container leaking water from its flanges. When the water leaking occurs, please remove the films from the flanges and retry to set them on the flange.

*The wrinkles of films on the top of the flange cause water to leak from the small container.

[3] Check the smoothness of sliding the small container in and out of the large container

1. When the small container has no water leaking, check the smoothness of sliding it in and out of the large container. In case of the small container slides hard into the large container due to the films, please cut the superfluous films with a pair of scissors to adjust sliding smoothness.

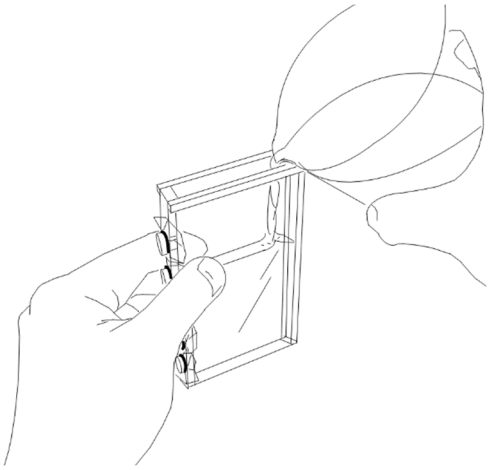


Fig.3 Pouring water

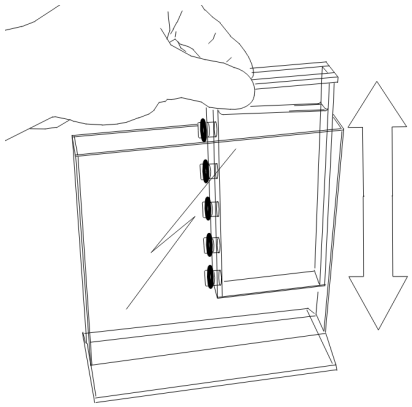


Fig.4 Checking smoothness

[4] Inject electrolytes into the containers

1. After finishing "[2] check water leaking from the holes and the flanges of the small container" and "[3] Check the smoothness of sliding the small container in and out of the large container," drain the water from the small container.

2. On a plastic tray, insert the small container into the large container and carefully inject copper sulfate solution into the small one using a pipette or a dropper until the surface of the solution is over the top of the hole (Fig.5).

4. Check whether the holes include air bubbles. When the air bubbles are in there, purge the bubbles away with the pipette or the dropper with the solution (Fig.6).

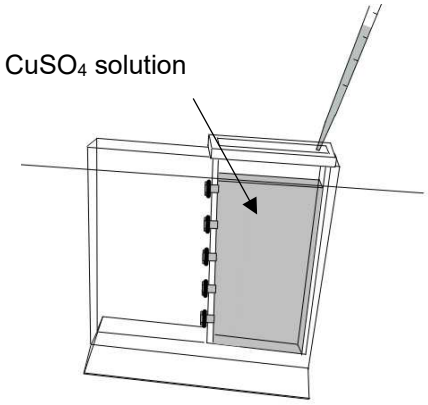


Fig.5 Injecting copper sulfate solution

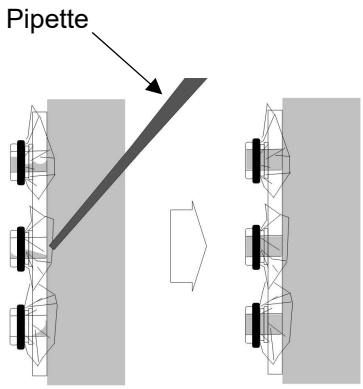


Fig.6 Purge the air bubbles

5. Inject carefully zinc sulfate solution into the large container using another pipette or another dropper to reach the same level of copper sulfate solution in the small container (Fig.7).

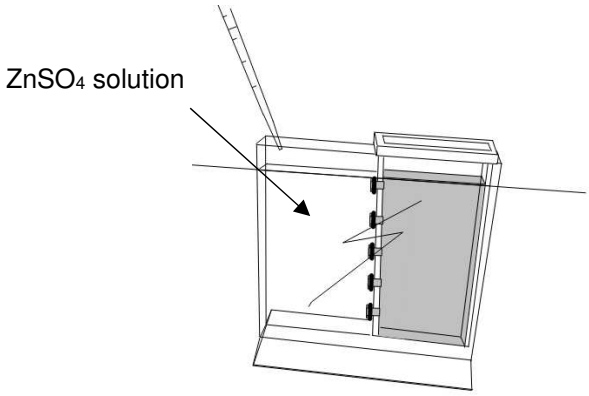


Fig.7 Injecting zinc sulfate solution

If injecting zinc sulfate solution into the large container first, the small container may be floated and be unstable. Please inject copper sulfate solution into the small container first.

[4] Set up the electrodes

1. Attach each electrode to terminals using knuckled screws.
2. Slide only the zinc electrode plate into an electrode holder until the holder touches the electrode terminal.

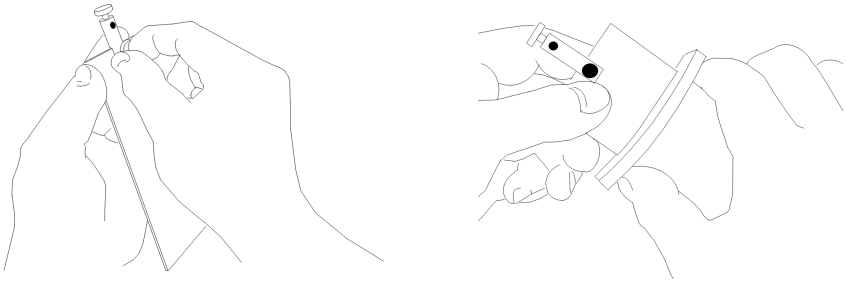


Fig. 8 Attaching the electrode to the terminal

3. Set carefully the electrode in the large container filled with zinc sulfate solution.
4. Set carefully the copper electrode in the small container filled with copper sulfates solution. This electrode doesn't require an electrode holder because the electrode plate touches the bottom of the small container.

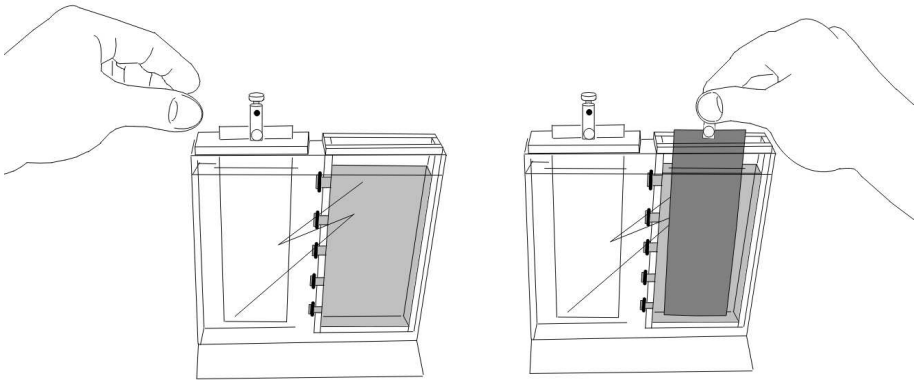


Fig. 9 Set the electrodes to the containers

[Tips:] Please make an even surface level of each solution and each height of the electrodes in the containers for your beautiful demonstration.

Demonstration with Accessory Module

[1] Accessory module with built-in electric melody and propeller motor

The accessory module consists of a propeller with a motor and an electric melody unit and has a simple structure. The purpose of using this accessory module is to demonstrate to students that the Daniell Cell generates electricity.

It has independently two switches for the propeller motor and the electric melody unit. When the Daniel Cell connects to the module, the propellor motor will work, or the melody unit will play.

The propeller and the melody unit hardly work at the same time due to the generating capacity of the Daniell Cell.

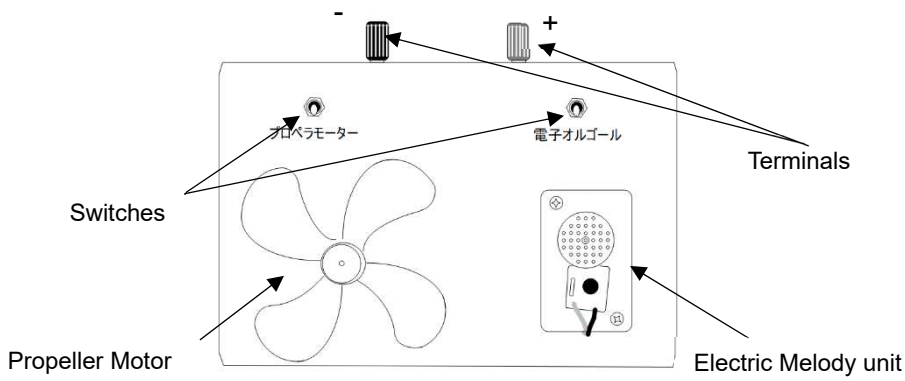


Fig.10 Accessory module with built-in electric melody and propeller motor

1. Connect the Daniell Cell and the module using lead wires with clips (zinc electrode - red terminal, copper electrode - black terminal).

2. For the propeller motor: Turn on the switch of the propeller motor, it starts rotating. It demonstrates that the Daniell Cell generates electricity. Then switch it off.

3. For the melody unit: Turn on the switch of the melody unit and it starts playing. It demonstrates that the Daniell Cell generates. Then switch it off.

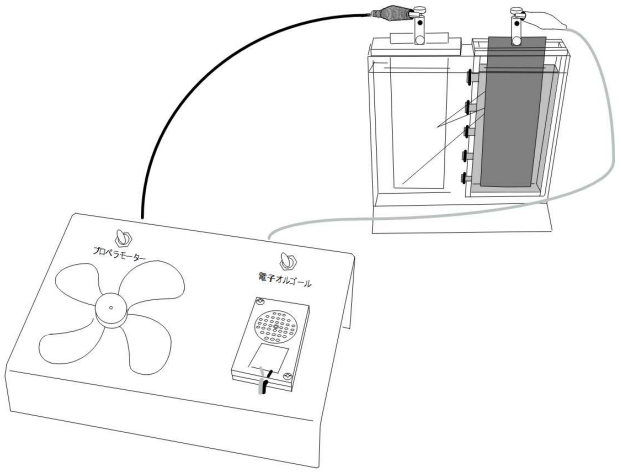


Fig. 11 Completed Large Daniell Cell for demonstration

Optional Demonstration

These containers and electrode plates allow wide applications not only Daniell Cell. For example, Using dilute sulfuric acid as an electrolyte enables a demonstration of Voltaic Cell to students, or connecting electrode plates to a DC power supply enables a demonstration of electrolysis to students.

Maintenance

[1] For long storage,

1. Remove the electrodes from the containers, wash and dry them.
2. Drain the electrolytes from the containers to other storage containers after the demonstration and keep the electrolytes.
2. Remove the O-rings and the films from the small container.
3. Wash the containers with water and dry them.

Don't leave the solutions in containers for long storage. Otherwise, the electrolytes precipitating and crystallizing in the containers cause closing holes.

[2] Usable continuous time: approximately 6 hours.

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Narika confirmed that the Large Daniell Cell will continuously work for up to 6 hours, the two electrolytes may mix and lose their reactivities, and the electrodes oxidated and reduced by the reaction rusts to lose their reactivity. Thus, if you would keep them in long storage, refer to "For long storage".

[3] Used electrodes

For reuse and/or storage, wash, dry, and polish them immediately after the experiment. In case they have cracks, dispose of them following the local regulation.

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