

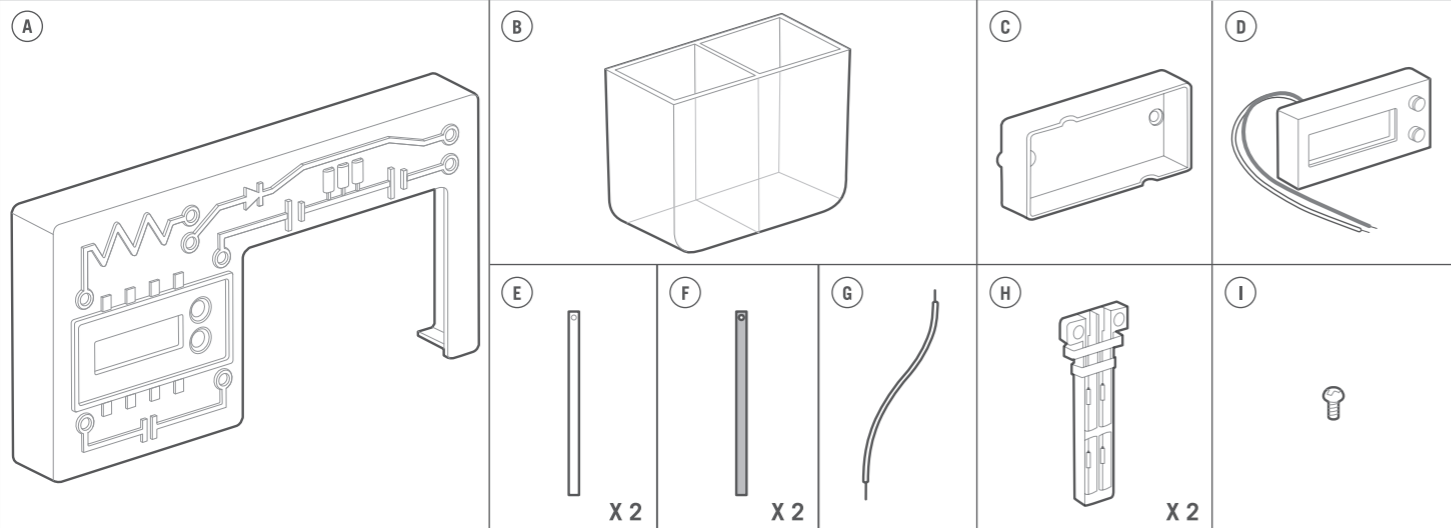
# WATER POWERED CLOCK

**⚠ WARNING:**  
 CHOKING HAZARD - Small parts  
 Not for Children under 3 years.  
 TO PARENTS: PLEASE READ THROUGH THESE INSTRUCTIONS  
 BEFORE GIVING GUIDANCE TO YOUR CHILDREN.

## A. SAFETY MESSAGES

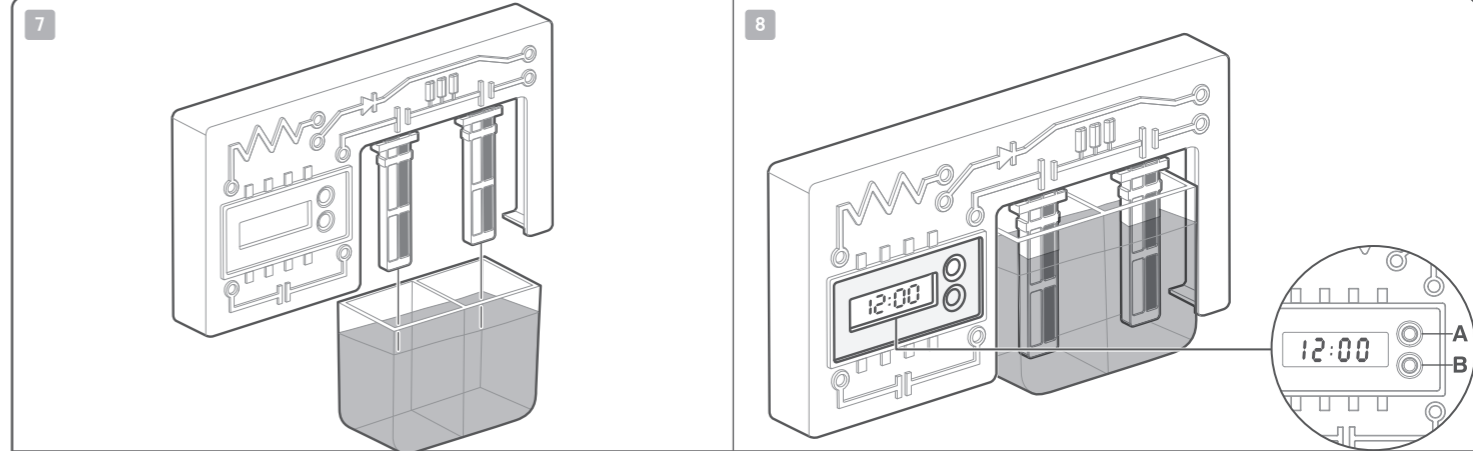
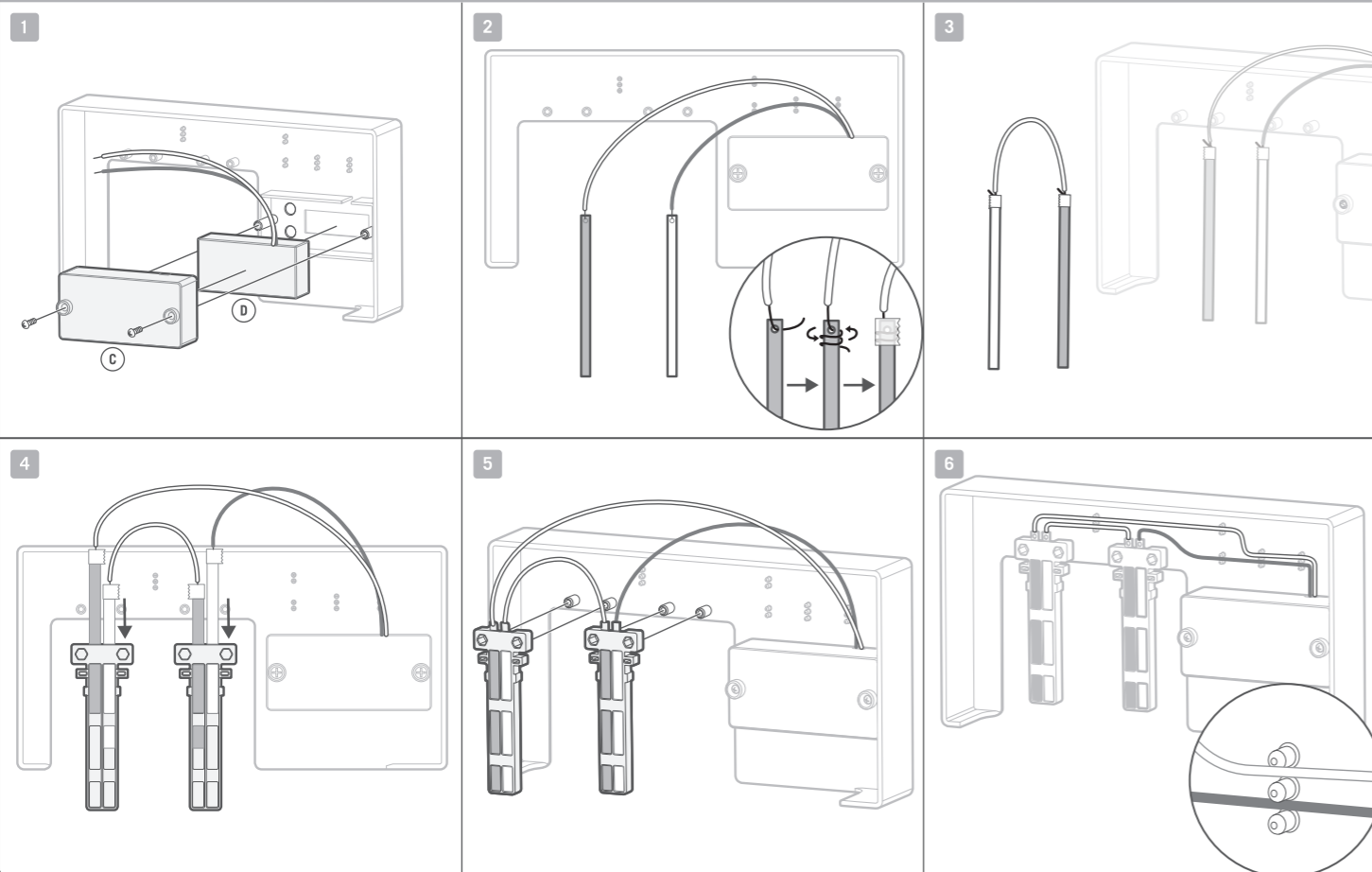
1. Please read through these instructions before you start. 2. Adult supervision and assistance are required at all times. 3. Intended for children of ages 8 and up. 4. This kit and its finished product contain small parts which may cause choking if misused. Keep away from children under 3 years old. 5. Metal parts may have sharp edges. Adult assistance is required when assembling these parts. 6. Do not connect any of the parts provided to any AC wall socket or any batteries. This may cause electric shock or a short circuit. 7. The LCD watch may temporarily lose its function at electrostatic discharge environment, but it resumes its normal function by resetting the device.

## B. CONTENTS



Part A: Clock frame x 1, Part B: Water container x 1, Part C: Clock module rear case x 1, Part D: Clock module x 1, Part E: Zinc strip x 2, Part F: Copper strip x 2, Part G: Wire x 1, Part H: Electrode holder x 2, Part I: Screws. Also required but not included in this kit: a small crosshead screwdriver, table salt, sticky tape.

## C. ASSEMBLY



1. Slot the clock module into the frame so that the two buttons on the module fit into their holes in the frame. Place the clock module rear case over the module, making sure that the wires from the module come out through the cutout in the case and secure with two screws.  
 2. Connect the white wire from clock unit to the end of one copper strip. To do this, push the bare end of the wire through the hole in the strip, and twist the wire around the copper strip a couple of times. You can secure the wire with a small piece of sticky tape from home. Connect the green wire to one zinc strip in the same way.  
 3. Connect the remaining zinc strip and the remaining copper strip together with the single wire.  
 4. Slide the zinc and copper strips into their slots in the electrode holders as shown. Each holder must contain one copper strip and one zinc strip.  
 5. Slot the electrode holders into the frame.  
 6. Clip the wires into place in the frame.  
 7. Fill the compartments in the water container with water and stand the clock upright so the electrode holders are immersed in water.  
 8. The clock should begin to work. Remarks: Refill the water container regularly to ensure the water is deep enough to cover the metal strips.

## D. SETTING THE CLOCK

1. Setting the clock: When all the metal strips are immersed in the water, the LCD screen will light up. It will show a static display of "12:00" and the two dots in the middle will start flashing. When you see this, the clock is now working. Press B twice to obtain the set month mode, then press A to adjust to the right month. Press B to confirm and the display will switch to the set day mode. Press A to adjust to the right day. Press B to confirm and switch to the set hour mode. Press A to adjust to the right hour. Press B to confirm and switch to the set minute mode. Press A to adjust to the right minute and press B to confirm. After the minute is confirmed, press A once. The set time will be displayed.  
 2. Viewing the clock: By default, the clock display shows the current time. To view the date, press A once. The clock display will resume showing the current time after 2 seconds. To view the seconds, press A twice. To resume the current time, press A again.

## E. TROUBLESHOOTING

If the clock doesn't start working, or it stops working, try one of the following:

- Make sure the wire connections are correct and the bare end of the wires are touching the metal strips.
- Wait for a few minutes – the flow of electricity will increase after a while when you first put the metal strips into water.
- Add a pinch of table salt to the water in each compartment, which will help the electricity to flow.
- Make sure that the water is deep enough to cover the metal strips.
- If the clock display is dim, try removing the metal strips from their holders and cleaning them by rubbing them with sandpaper, then put them back.
- If precipitates accumulate and make the water look muddy, simply clean the water container and refill with clean water.

## F. HOW IT WORKS

The metal strips and the water make a battery. The battery and the clock form an electric circuit, and the battery pushes an electric current around the circuit, making the clock work. There are two sets of strips, each in a container of water. Each set, made up of a zinc strip, a copper strip, and the water around them is called an electrochemical cell. Two or more cells like this together form a battery. Two cells are needed because a single cell would not be powerful enough to power the clock. The way each cell works is a little complicated. It involves some of the extremely tiny particles called electrons that are part of atoms. The electric current that works the clock is made up of a flow of electrons. When the metal strips are put in the water, chemical reactions begin to happen. At the zinc strip, atoms of zinc lose some electrons to become zinc ions, and move into the water. The electrons flow along the wire from the zinc strip towards the clock, making the electric current that makes the clock run. Electrons coming around the circuit from the clock go into the copper strip. They combine with water and oxygen that's dissolved in the water to make particles called hydroxide ions. These combine with the zinc ions from the zinc strip to form a chemical called zinc hydroxide. If you add salt to the water, the chemical reactions change a little. The salt is a chemical called sodium chloride. It dissolves in the water to make sodium ions and chloride ions. These make the chemical reactions in the cell happen faster, so the cells can produce more electricity.

## G. FURTHER EXPERIMENTS

Put some soft drink into the compartments in the water container. Insert the copper and zinc strips into the compartments, as shown in the diagram, taking care that the metal strips do not touch each other. The clock should now start to work. You may experiment with different liquids like salt water, fruit juices, or fruit like lemon, orange, tomato etc. The fun is unlimited.

## H. FUN FACTS

- You can make a battery from a lemon. Sticking a copper nail and a zinc nail into a lemon makes a battery that works using the acid in the lemon.
- You can even make a battery with a potato! Sticking copper and zinc strips into a potato makes a battery with the same power as water-powered battery.
- There were water-powered clocks hundreds of years ago, before anybody understood electricity. The clocks were mechanical and used a steady drip-drip of water to measure time.
- Engineers at South Korea's Ulsan National Institute of Science and Technology (UNIST) have invented a rechargeable seawater battery that runs on water and salt.
- Some sorts of emergency equipment used on ships and boats, such as lifebuoys, lights and weather balloons, have batteries that are activated when they are immersed in seawater.